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TECHNOLOGY DEPT.



# MODERN PLASTICS



JUNE 1944

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# DESIGN DATA ON PLASTICS

## VI. An Unusual Molding Operation at RCA

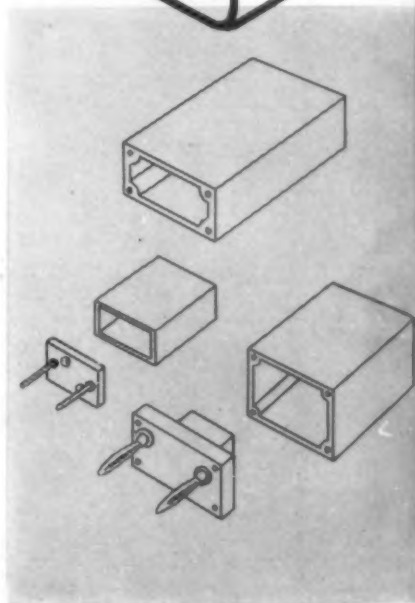
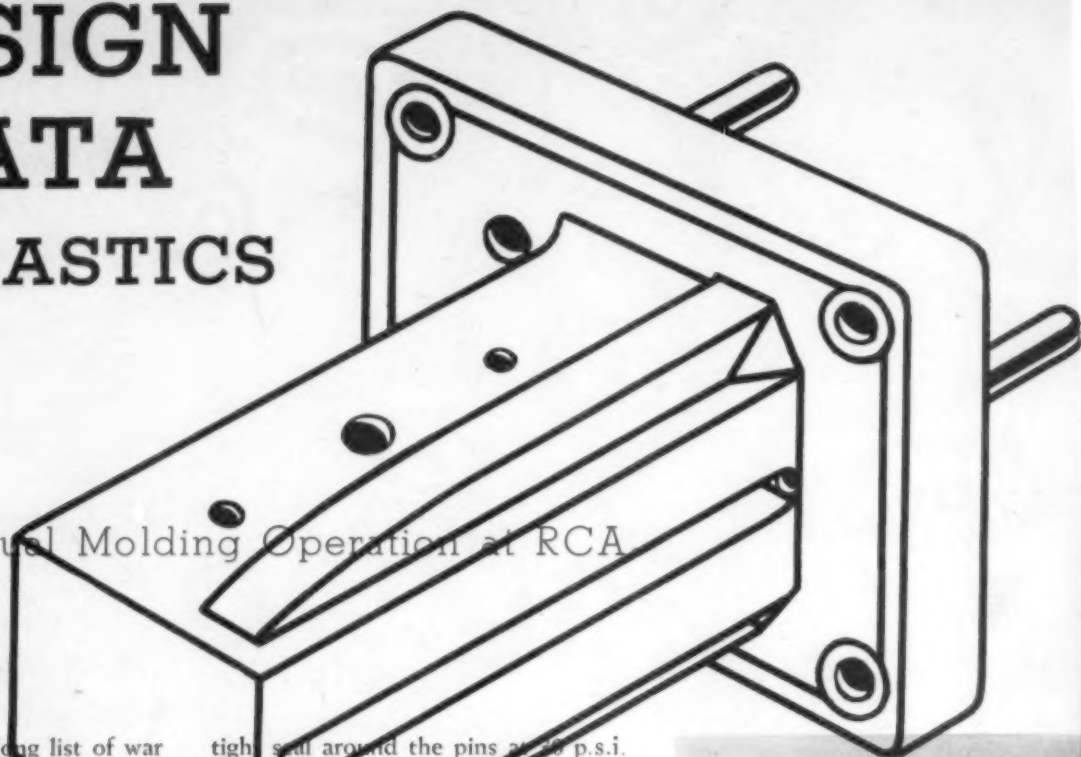
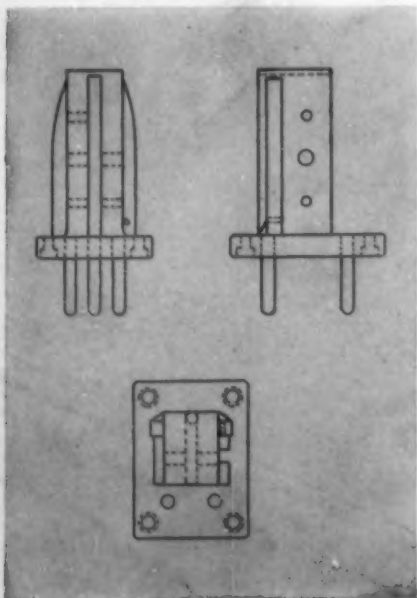
Adding another to its long list of war contributions, RCA is now in large-scale production with a series of redesigned crystal holders—all molded from a Durez phenolic plastic. Of all-important interest is the new efficiency achieved, which permits small holders to supplant larger sizes formerly used. A saving of 50% in quartz crystal is being realized.

Of interest to designers and engineers, however, is the ingenuity which RCA has put into the job. In designing the molds two major problems became evident. RCA engineers wanted a water-

tight seal around the pins at 40 p.s.i. The second problem was the need for a key which would keep the material out of the plug opening, and eliminate removal of flash from the opening. It was an especially "tough nut to crack" because the plug opens directly into a slot which is bridged at the end.

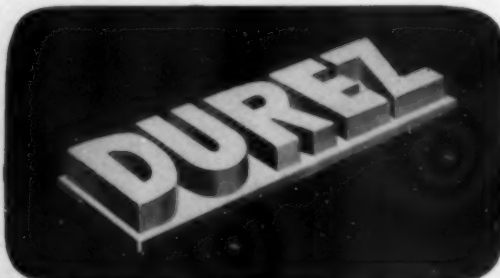
Because a direct draw could not be used, the side-action key fixture was designed in two parts. The upper part is removed by a straight sideway motion, and the lower half is removed by a slightly upward and then sideway motion.

This molding achievement has been accomplished with a Durez phenolic plastic—added evidence of the outstanding moldability of Durez, and added proof of the familiar Durez line "Plastics That Fit the Job." In the production of hundreds of current items, it has been found that the moldability and versatility of Durez compounds contained the ideal answer.



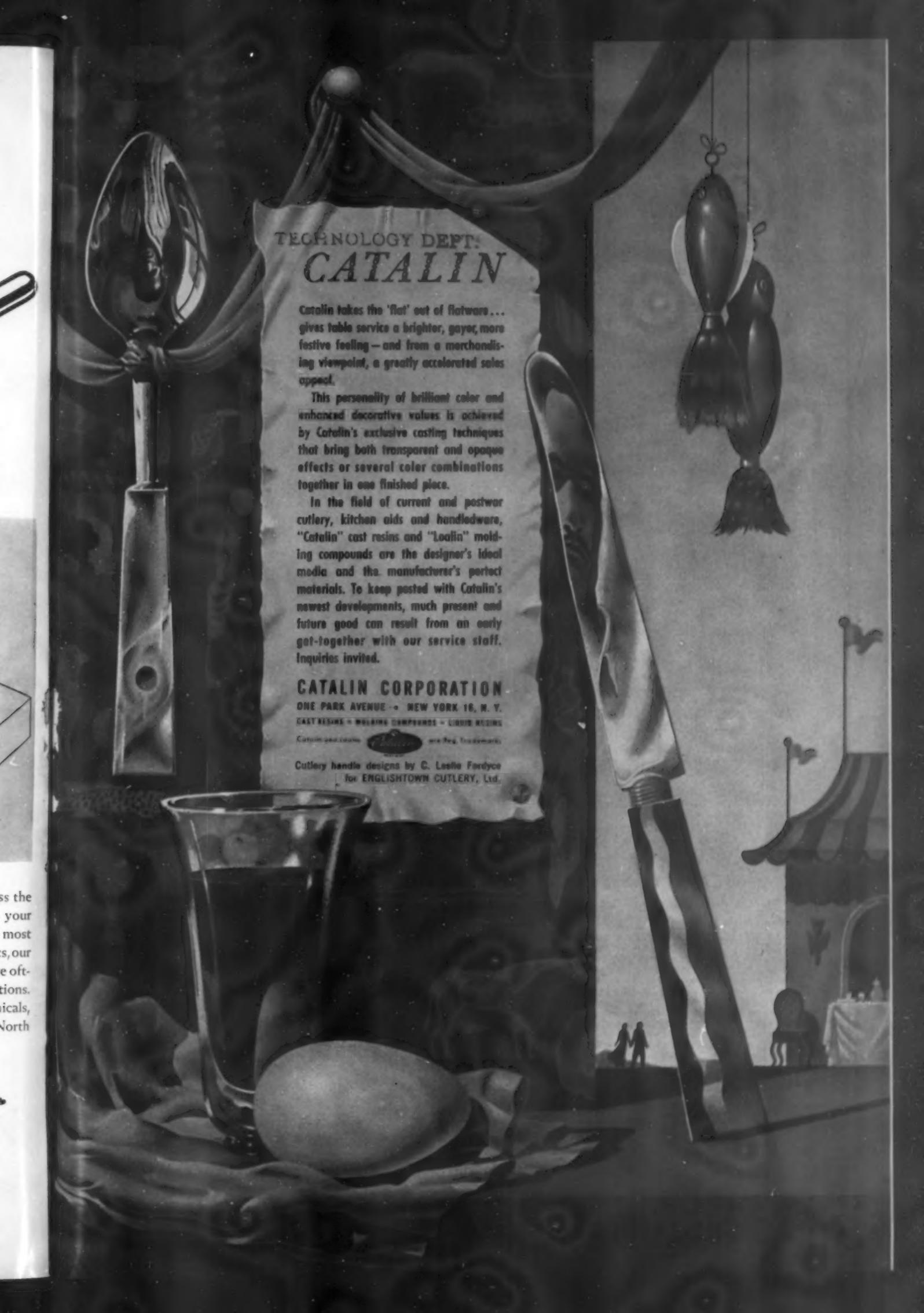
We welcome the chance to discuss the advantages of Durez plastics for your needs. As one of the oldest and most experienced producers of phenolics, our laboratories and technical staffs are often able to make valuable suggestions.

Durez Plastics & Chemicals, Inc., 56 Walck Road, North Tonawanda, New York.



PHENOLIC  
MOLDING COMPOUNDS  
AND RESINS

**PLASTICS THAT FIT THE JOB**



TECHNOLOGY DEPT.  
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Catalin takes the 'flat' out of flatware... gives table service a brighter, gay, more festive feeling — and from a merchandising viewpoint, a greatly accelerated sales appeal.

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In the field of current and postwar cutlery, kitchen aids and handledware, "Catalin" cast resins and "Loalin" molding compounds are the designer's ideal media and the manufacturer's perfect materials. To keep posted with Catalin's newest developments, much present and future good can result from an early get-together with our service staff. Inquiries invited.

**CATALIN CORPORATION**

ONE PARK AVENUE • NEW YORK 16, N. Y.

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# MODERN PLASTICS

AND PLASTICS

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JUNE 1944

NUMBER 10

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## Announcement of importance to the Plastics Industry



**Highly versatile synthetic materials  
offered to manufacturers and fabricators**

FROM GEON may be made a wide variety of thermoplastic elastomers which can easily be extruded, pressure or injection molded, calendered, cast into sheet and film, or used as coatings for fabric and paper.

*The following properties in innumerable combinations may be found in products of GEON:*

Flexible	Wide range of colors
Waterproof	and luster
Light weight	Electrical insulation
High tensile strength	Odorless
Easily embossed	Wide hardness range

### *Resistance to*

Acids	Light	Mildew
Alkalies	Air	Cold
Chemicals	Aging	Heat
Foods	Flame	Abrasion
		Sticking

Already many new — and, in some cases, revolutionary — uses have been found in such fields as plastics extrusion and molding, electronics, metals, textile, paper, packaging, rubber, food and beverage, and many others in which a seemingly limitless number of uses is yet to be discovered. For example, it has just been found that GEON, when properly blended, improves a synthetic rubber's resistance to sunlight.

Does all this suggest some new product or application or use to you? Our research staff and laboratory facilities are ready to help you. Chemical Division, The B. F. Goodrich Co., Rose Building, Cleveland, Ohio.

*For an informative folder which further describes GEON'S properties and suggests many applications, or for answers to your questions, write Dept. 1-1, Chemical Division, Rose Building, Cleveland 15, Ohio.*

GEON is available to industrial users subject to allocation under General Preference Order W-30. Limited quantities can be had for experiment.

"THAT REMINDS ME—

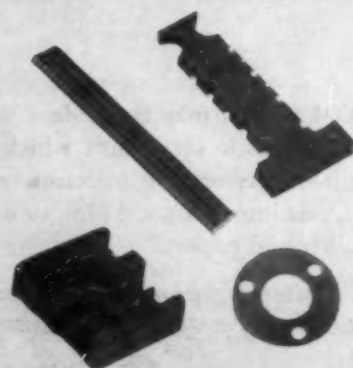


## INSUOK HAS EXCEPTIONAL TENSILE STRENGTH"

● Many a product designer has heaved a sigh of relief upon learning that INSUOK is a combination of "beauty and the beast"—that it not only has an attractive appearance but also has ample tensile strength to meet the requirements of scores of postwar products.

Because INSUOK is also light in weight, it is being used in dozens of wartime products, today—will provide competitive advantages for other types of products, tomorrow.

INSUOK, Molded and Laminated, is made in a wide range of grades and types—with combinations of characteristics which make it the preferred material for innumerable electrical, chemical, mechanical and decorative applications. Richardson Plastics will be glad to work with you or your designer in determining the type of INSUOK best suited to your needs. Write for complete information.



*Unless users are going to "baby" your product, it may be advisable to give it the advantages of INSUOK'S high tensile strength.*

# INSUOK *Precision Plastics*

## The RICHARDSON COMPANY

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# New landing light lenses molded of "LUCITE"

**Du Pont "Lucite"**  
reduces weight and breakage,  
provides weather resistance and  
dimensional stability.  
**Lens design boosts candlepower.**

NEWS of another demonstration of the many advantages of Du Pont "Lucite" methyl methacrylate resin comes with the armed forces' release of the description of field lighting equipment in which this versatile plastic plays a major part.

The armed forces wanted this equipment to have light weight and resistance to breakage. It was necessary at the same time to improve the optical accuracy while maintaining good dimensional stability and weather resistance.

"Lucite" met all these requirements and made possible, in addition, a design which almost tripled candlepower from the same light sources.

Do you have problems involving similar needs? "Lucite" may be the answer. Du Pont plastics technicians will lend you the help of their experience in solving plastics problems on war and development work. Address inquiries to: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J., or 5801 So. Broadway, Los Angeles 3, California. In Canada: Canadian Industries, Ltd., Box 10, Montreal.

**AVAILABLE:** Special story on Heat-Resistant "Lucite" molding powder. Write on your business letterhead for your copy.

## DU PONT PLASTICS



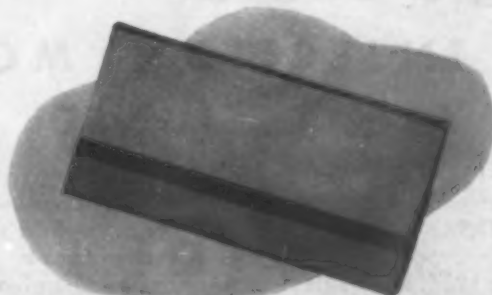
BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY



**BEFORE AND AFTER** the introduction of "Lucite" . . . a marker lens, part of the field lighting equipment. This is an ellipsoidal Fresnel lens, providing concentrated high candlepower beam at certain angles. Old lens weighed 39 ounces; new "Lucite" lens weighs about 3 ounces. High finish of mold surfaces makes the most of the high degree of light transmission of "Lucite." Because of high wattage and temperature of bulb, Heat-Resistant "Lucite" is used for these lenses . . . is injection-molded from top center sprue. Molder of all the lenses illustrated on this page is Stimson A'G'A Plastics.

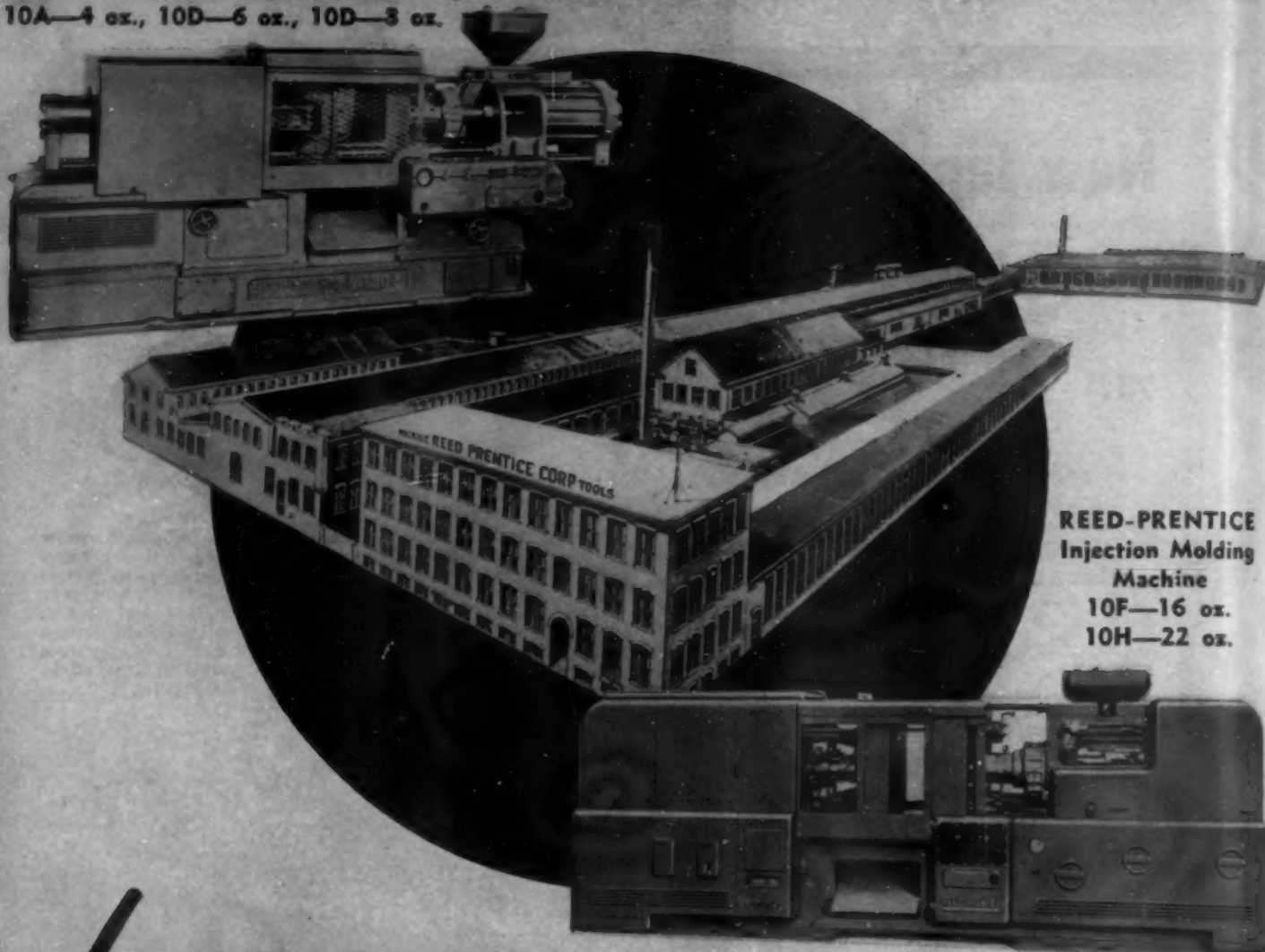


**ANOTHER IMPORTANT** weight reduction is effected by use of Heat-Resistant "Lucite" for the obstacle lens. Old lens weighed 26 ounces; lens of "Lucite" only 3 ounces. Note three-color lens below.



**INTERESTING DEMONSTRATION** of the workability of "Lucite" is this tri-color lens, the application of which is still restricted. Three flat molded strips of general purpose "Lucite"—yellow, green, and red—are welded into a single homogeneous optical lens unit, an extremely accurate job in which skillful workmanship and good material combine to produce a superior product.

**REED-PRENTICE Injection Molding Machine**  
 10A—4 oz., 10D—6 oz., 10D—8 oz.



**REED-PRENTICE  
 Injection Molding  
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 10F—16 oz.  
 10H—22 oz.

# *Where* **REED-PRENTICE**

**INJECTION MOLDING MACHINES  
 ARE DESIGNED AND MANUFACTURED**

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Since 1937, REED-PRENTICE has produced nearly 600 Injection Molding Machines which have been shipped to all parts of the United States, as well as Canada, Mexico, South America, England and Australia. This wide acceptance has kept us in close touch with the entire plastic field and, therefore, with the developments and needs

of injection molders. Their requirements, in turn, have been quickly incorporated as improvements on new machines and made available to earlier owners of our machines. The record of accomplishment by REED-PRENTICE machines is strongly allied with the progress of one of the fastest growing phases of the plastic industry — Injection Molding.

REED-PRENTICE Injection Molding Machines are available in sizes 10A-4 oz., 10D-6 oz., 10D-8 oz., 10F-16 oz., and 10H-22 oz.



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All over the world GI Joe is grateful for these lightweight clean-up accessories. Naturally, he doesn't know they're made of Lumarith C.A. and Lumarith X, but the fabricator was keenly conscious of that fact. He knew that when it comes to moisture-conditions, wear, impact shock, and torque, Lumarith can take it.

Celanese plastics have traditionally been specified for combs, hairbrush backs, toothbrush handles, tank floats, mouthpieces, and so on, so that it's

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**Lumarith** A CELANESE<sup>®</sup> PLASTIC

•Trade-marks Reg. U. S. Pat. Off.

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To Postwar Planners:

This is the time  
to pump our experts  
about problems in plastics.

Our research  
and engineering staffs  
ad-lib no answers.

They study, cogitate,  
ruminate, and sweat  
out the solution

based on

Pro-phy-lac-tic's

100 years of experience  
in plastics production.

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## **PROLON PLASTICS**

# THE CARVER LAMINATING PRESS



*The Carver Laminating Press is available for prompt deliveries. Information on request.*



The Carver Laminating Press is in general use in war plants, government offices, military bases and other restricted areas, for the production of *tamper-proof* identification cards and badges. These passes, bearing the individual's photo and other personal data, are permanently laminated between transparent sheets of cellulose acetate by hydraulic pressure with the Carver Laminating Press. (We do not supply cards, badges or plastic materials.)

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The time is not yet ripe to reveal results; RCI is, naturally, working only for Victory now. But you can be assured that when peace comes, with it will come new RCI products that will fully uphold this organization's reputation as a foremost exponent of progress in every sense of the word.



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# A World of Uses

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### Tubing Pipe and Fittings

**MILLS PLASTIC** \* tubing, pipe and fittings daily increase their already wide variety of applications . . . and continually contribute solutions to apparently insurmountable problems. **MILLS PLASTIC** has successfully demonstrated its practical adaptability under high bursting and working pressures. Plus this, its exceptional characteristics and proved resistance to most chemicals, flexibility, insulation qualities and ease of handling . . . in many cases make it superior to the vital metals it has replaced . . .

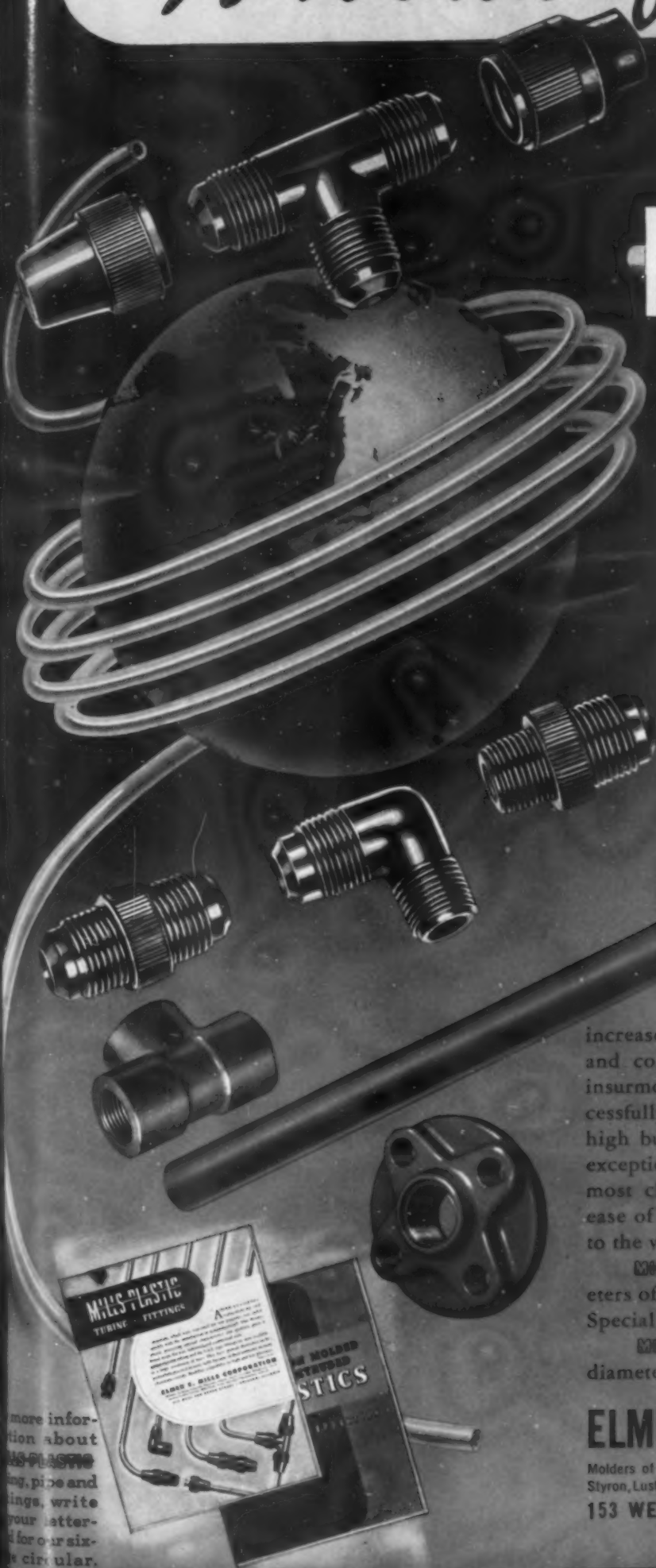
**MILLS PLASTIC** tubing is available in outside diameters of  $\frac{1}{8}$ " through  $\frac{3}{4}$ " in a variety of wall thicknesses. Special sizes on request.

**MILLS PLASTIC** pipe can be obtained in outside diameters of  $\frac{1}{2}$ " through 4".

*\*Made of Saran.*

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fittings, write  
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It's a far cry from the early ash tray-and-gadget stage to the use of plastics for functional parts like this washing machine agitator. Molding such large parts calls for special skills . . . in mold design and in production technique. The ability to take such problems in our stride has enabled us to fit plastics to many new applications . . . where they do a job better than any material previously used.

Take this agitator, for example. It is light yet strong and resilient. Dirt cannot lodge

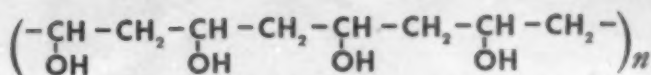
against its mirror-smooth surface. Moisture absorption is low. Soap and hot water do not corrode it, and the plastic itself has no corrosive effect.

Your problem may require similar high strength to weight ratio . . . similar non-corrosible qualities, good electrical properties, or merely new eye-appeal. In any case, send us your specifications for quotation, or ask one of our engineers to consult with you. **MOLDED PRODUCTS COMPANY**, 4533 W. Harrison St., Chicago 24, Illinois.

PLASTICS DIVISION  
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**WHITE TO CREAM-COLORED powder**, bulk density 0.4-0.6 (Sp. Gr. 1.21-1.31). Not attacked by bacteria or fungi under ordinary conditions. Can be blended with pigments, fillers and plasticizers for extrusion and molding into finished articles, or into sheets that may be used as preforms for molding or stamped into finished objects.

**SOLID**—Can be used with or without plasticizers, fillers, or other modifiers to produce rubber-like masses having Shore Hardness 10 to over 100. Molding can be effected at 250-300° F, 500-1500 psi. Moldings are transparent or translucent, depending on the filler, and are tough, resilient, flexible and abrasion-resistant.

**AQUEOUS SOLUTIONS**—Viscosity and solids content may be varied independently over a wide range. Solutions are compatible with plasticizers wetting agents and other compounds used as adhesives and binders. Readily dispersible in mixtures of

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**FILMS AND COATINGS**—Easily obtained by spraying, dipping or coating machine application and subsequent evaporation of water. They are transparent, strong, tough, abrasion-resistant, impervious to gases and vapors other than water vapor; have high tensile and tear strength, self-sealing properties and resistance to all common oils, fats, waxes and organic solvents. They are swelled by water, can be made water-resistant but not waterproof.

## TYPICAL APPLICATIONS

*Molded or extruded products* can be used for gas-, grease-, solvent-proof washers, gaskets, diaphragms, printing rollers, etc. *Water solutions* may be used in preparing adhesives and binders for ceramic materials, paper coatings, textile sizings; for emulsifying oils, fats and waxes; as binders in shoe-leather dressings; in cosmetic and pharmaceutical formulations; for dip, spray and machine coating of threads, fabrics, paper, metals,

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ONE PINT OF YOUR BLOOD MAY SAVE A FRIEND'S LIFE!

## DU PONT ELECTROCHEMICALS



BETTER THINGS FOR BETTER LIVING THROUGH CHEMISTRY



PHOTO—BELL AIRCRAFT CORPORATION



# Thread FOR SEWING STEEL

Everyday, welding rods in countless numbers, link patterned pieces of structural steel together to form mighty weapons for Victory. And every day war-time packaging safely delivers these vital rods to widely scattered scenes of construction. Never before has product packaging played so important a role.

Needless to say, each war-time packaging assignment is carefully studied by H & D Package Engineers, to gather from it every possible application that will make for better post-war packages; for surer, safer, undamaged deliveries.

Most of the new and better products of tomorrow will travel the rail, sea, sky and highways of the world in scientifically engineered corrugated boxes. So in planning your post-war packages—and now is the time—look to H & D for rugged, reliable corrugated boxes. Skilled H & D Package Engineers—authorities on packaging—know the correct formula for packages that protect and promote the product.

BUY WAR BONDS — KEEP THEM FOR FUTURE USE

## Tells HOW to SHIP More Economically in Corrugated Boxes

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For postwar packaging... better see

**H&D HINDE & DAUCH**

AUTHORITY ON PACKAGING . . .

CORRUGATED SHIPPING BOXES

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**For Engineers and Purchasing Agents**

**BY THE PIONEER  
CUSTOM INJECTION  
MOLDER OF AMERICA**



**T**HE high quality of Erie Resistor Plastic Products reflects the knowledge and experience of Erie Resistor engineers.

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Write our Engineering Department concerning any problem involving Injection or Extrusion Molding, or Injection Molded Thermosetting Plastic articles, in sizes ranging from 1/2 ounce to 18 ounces inclusive. Our new illustrated bulletin describes our facilities and background in detail. A letter to us will bring a copy to you.



*Plastics Division*

**ERIE RESISTOR CORP., ERIE, PA.**

LONDON, ENGLAND • • TORONTO, CANADA

*Let's All Back The Attack—Buy EXTRA War Bonds*

Want a share in a Boundless Future?

● Only a reckless prophet would try to set boundaries for the use of plastics in the future toward which we are inevitably headed. The list of plastic use in war equipment is fantastically long—and lengthens steadily. Owens-Illinois, through its long use of plastics as closures for containers and constant experimenting with new formulae and processes, is ably and amply equipped to help you solve packaging problems that seem to stand between you and your use of these astounding newcomers to the American scene.

TUNE IN "BROADWAY MATINEE," presented by Owens-Illinois in co-operation with your government, every day, Monday through Friday, 4 P.M., E.W.T.; 3 P.M., C.W.T.; 2 P.M., M.W.T.; 1 P.M., P.W.T.

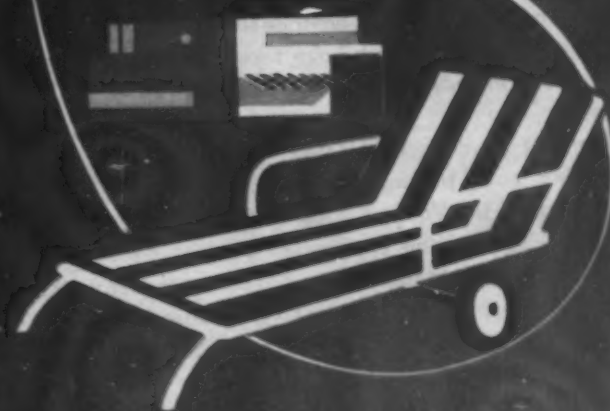
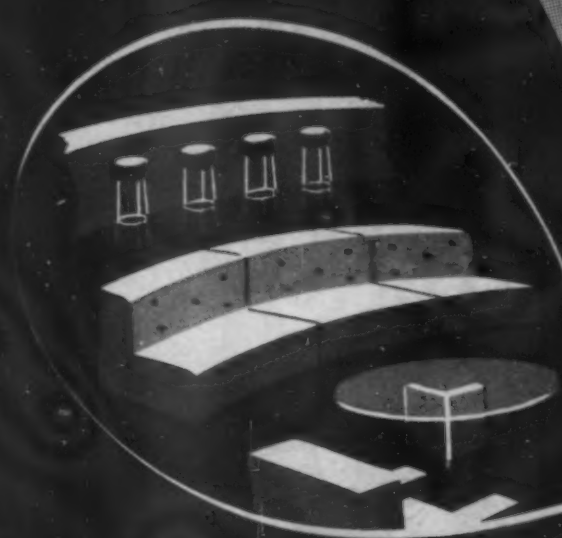
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INTERIOR OF

# VELON

a new high in eye appeal  
a new low in maintenance cost!



Imagine cocktail rooms, lobbies, terraces, undisturbed and decorated in a material practical in every bright or delicate color! A material available in a wide variety of weaves and patterns for built-in seating, chairs, draperies, screening, paneling.

Imagine a material so indestructible that, in three years of actual use it shows no sign of wear! No fraying, no tears. No spots or stains. No fading or discoloring. Non-inflammable and highly resistant to acids and greases, alkalis and solvents.

Best of all, this material absorbs no dirt, no moisture—can be wiped clean and colorful as new in a few seconds.

This wonderful material is Firestone's Velon. All production now goes to war—but watch for Velon's release! You'll want to be among the first to adapt this brilliant answer to decorating and maintenance problems—"Interior of Velon!"

P.S.—For completely modern seats, make the cushioning FOAMEX.

ANOTHER CONTRIBUTION TO A

BETTER WAY OF LIFE by

# Firestone

Trademark • pronounced VEL-LON



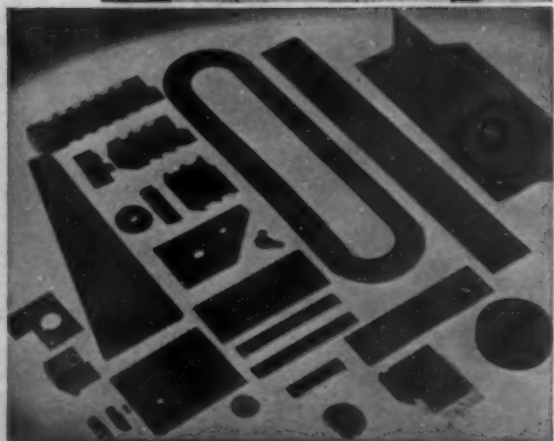
**L**IGHTER weight, greater speed, higher safety standards, longer life, lower travel and transportation costs . . . have been the lengthening shadows which have forecast our modern methods of overland transportation.

One C-D product, **DIAMOND Vulcanized FIBRE**, early presaged revolutionary design changes. DVF is a tough, strong **NON-metallic**, with an extremely favorable, strength-weight factor when compared to metals. It has a natural resilience and great ability to absorb shocks and vibration. It is a good electrical insulator. It is readily punched, machined or formed.

In 1911 C-D introduced **DILECTO**, a laminated plastic, first called "waterproof fibre." **DILECTO** has played an equally important part in helping advance transportation methods. Wherever electricity must be controlled C-D **DILECTO** provides insulation that stands up under extreme conditions of temperature and moisture.

In adapting these and the other C-D **NON-metallics** to the "What Material?" problems of peace and war, the C-D laboratory has acquired a wealth of "know how" which is at your disposal to help you solve your "What Material?" problem.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C. West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities



C-D products include **THE PLASTICS** . . . **DILECTO**—a laminated phenolic; **CELORON**—a molded phenolic; **DILECTENE**—a pure resin plastic especially suited to U.H.F. insulation . . . **THE NON-METALLICS**, **DIAMOND Vulcanized Fibre**; **VULCROID**—resin impregnated vulcanized fibre; and **MICABOND**—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

**Continental - Diamond** FIBRE COMPANY

Established 1895 . . . Manufacturers of Laminated Plastics since 1911—NEWARK 28 • DELAWARE

# SOFTEN PREFORMS

get  
perfect  
flow—

**NO CORES!**



**LARGE MATERIAL HANDLING DRAWER is  
built-in and COMPLETELY ENCLOSED!**

Get perfect plasticity, plus many other advantages, with the new Thermex 2P unit. This new Thermex, designed exclusively for plastics, will heat preforms as fast as needed and with fully automatic operation—no tuning. Simply place the preforms in the aluminum drawer and close it. Closing the drawer starts heating cycle and automatic timer stops it. Opening drawer cuts out high frequency power. The 2P Thermex will greatly increase production and flexibility; improve quality; substantially reduce breakage, rejects and finished piece costs. It will also enable you to *handle larger, more intricate moldings and a greater variety of plastics and fillers.* Get details now about this important advancement from The Girdler Corporation, Thermex Div., Louisville 1, Ky.



THE NO. 2P

**Thermex**  
A GIRDLER PRODUCT

THE FIRST INDUSTRIAL HIGH FREQUENCY DIELECTRIC HEATING EQUIPMENT

# The **LARGEST** Tubing and the **SMALLEST**

*We specialize in mass production of tubings to close tolerances. Some sizes immediately available*

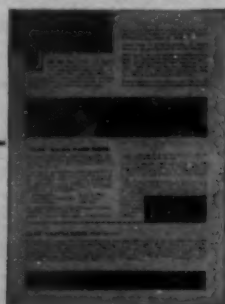


## Also **INTERLOX** REG. U. S. PAT. OFF. **Functional Shapes**

*for the building field and for general industry.*

### DATA SHEET

Upon request we will send you data sheet descriptive of TULOX TT tubing made from cellulose acetate butyrate and TULOX A tubing made from cellulose acetate showing physical properties and some standard sizes available together with prices. If you have special chemical or physical requirements we will be glad to work with you in the development of tubings to meet your individual needs.



## **TULOX** Plastic Tubing REG. U. S. PAT. OFF.

*... measured with a micrometer—not a yardstick!*

At Extruded Plastics, Incorporated, we specialize in the precision manufacture of TULOX tubing and INTERLOX functional shapes. We do neither injection nor compression molding, nor do we 'cut to length'. We are set up for mass production but we can offer, through our representatives, a number of standard sizes of tubings and functional shapes for immediate delivery for war and essential industrial use.

**CLOSE TOLERANCES.** On 'run of the mill', we hold to limits of plus and minus

one-half of one per cent. Even finer tolerances can be held on long runs.

**RAW MATERIALS.** Our exclusive process is applicable to many of the thermoplastic resins that are now in commercial production. Every one of these different resins offers its outstanding advantages together with certain disadvantages. There are rigid transparent tubings and flexible tubings that are not transparent but are resistant to intense cold. Others are highly resistant to chemical action. Write for data sheet.

*Through continuous research we pass on to customers  
the benefits of our experience*

## **EXTRUDED PLASTICS, Inc.**

NEW CANAAN AVE., NORWALK, CONNECTICUT, U.S.A.

*IN CANADA: Sole Licensees and Manufacturers*

DUPLATE CANADA, LTD., PLASTIC DIV., OSHAWA, ONTARIO



EST



**ECONOMICAL ONE-SHOT** injection-molding produces this intricate *Lumarith* telephone base, complete with metal insets.



**MORE PIECES** to the pound than with other heavier materials. Razors molded by Dillon-Beck of *Chemaco* cellulose acetate.



**EVERY BIT OF SCRAP** — including all channel pieces from injection molding—can be ground back to powder and re-used.

## CELLULOSE PLASTICS ARE *ECONOMICAL* !



Every feature of the plastics based on Cellulose points up their great economy in the process of molding and fabricating. They can be molded by injection and extrusion, which means high output per hour. They lend themselves to intricate one piece moldings, saving hours of assembly. Because of their lightness of weight, they produce more pieces to the pound of raw material. And, because they are true thermoplastics, there is no scrap to be thrown away—

all pieces can be ground and re-molded. Hercules does not make plastics, but as a leading producer of Cellulose derivatives—Cellulose Acetate, Cellulose Nitrate and Ethyl Cellulose—we are working constantly to supply those who do make plastics with even better and more versatile base materials. We have literature and other data based on our years of research, which we will gladly mail to you. Please address your letter Cellulose Products, Department MP-65.

**Hercules Powder Company, Wilmington 99, Del.**

**TOUGH • FLEXIBLE • STABLE • CLEAR • ECONOMICAL • LIGHTWEIGHT**

THIS IS A "SPRUE" showing how eight large acetate combs are produced, in a matter of seconds, with one quick shot of plastic into the injection mold. Some molds can produce up to 200 parts to the shot and 3 shots a minute.

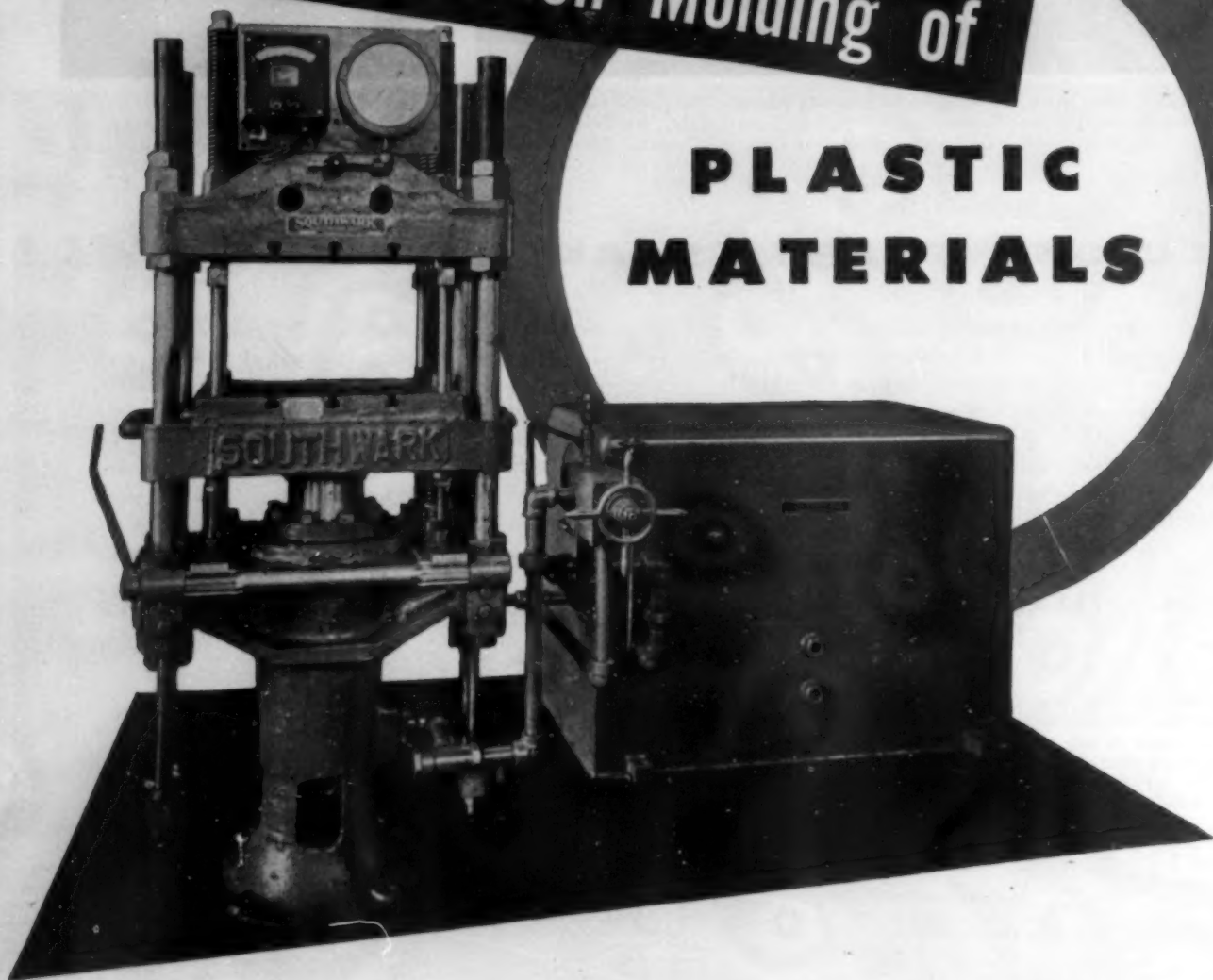


# HERCULES

**CELLULOSE ACETATE  
CELLULOSE NITRATE  
ETHYL CELLULOSE**

for Compression Molding of

## PLASTIC MATERIALS



A 50-ton semi-automatic molding press equipped with mechanical strippers top and bottom, column extensions for changing the daylight, self-contained pumping unit and adjustable electric pressure control. • Units of this character can be furnished with bolsters, parallel bars,

necessary equipment for transfer molding and in larger capacities. • The Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia, Pennsylvania, U.S.A. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Houston.



# BALDWIN



SOUTHWARK

**HYDRAULIC PRESSES**





# Watch the Tortoises

Remember Aesop's story of the Hare and the Tortoise? There is a lesson in it for every business executive who feels that postwar planning is something which can be deferred. The tortoises who keep plugging along day after day will get there ahead of the hares who think they can catch up later quite easily. Now is the time to do your postwar planning...not later on. We welcome inquiries from executives who are thinking now in terms of sales after the war.

THE **pyro** PLASTICS COMPANY  
WESTFIELD, NEW JERSEY



*Precision*  
**PLASTIC  
 MOLDING**  
*that meets  
 exacting  
 requirements*



The right combination of efficient designing and engineering assures you precision molding from high quality thermoplastic materials. Your exacting requirements are met promptly, efficiently and accurately, from small intricate designs to large 18 oz. moldings. Complete complementary equipment to answer your demand for plastic moldings, including complete dash panels, garnish moldings and similar trim.

Due to the allocation control of plastic materials, our production is at present restricted to direct war and essential civilian work.

Main Office and Plant  
 Este Ave. and Orient St.  
 Cincinnati, Ohio

Branch Plant — Sales Office  
 Richmond, Indiana

Sales Office  
 Detroit, Mich.



*The* **METAL SPECIALTY Co.**

MAIN OFFICE AND PLANT • ESTE AVENUE • CINCINNATI, OHIO

**PLASTIC DIVISION**

# Give "Green Hands" Blue Flash Performance

Here's help for "newcomers" . . . cut-off wheels that compensate to the fullest possible extent for workers' undeveloped skill . . . wheels that cut clean, free and straight with minimum amount of burr and burn . . . wheels that weather rough treatment.

Train "green help" to recognize features that add finesse to the quality of their work. With Bay State resinoid-bonded, rough-sided cut-off wheels, they get freer cutting action, longer life. Discoloration and heat are minimized because contact surface area is noticeably reduced.

Bay State makes wheels for every type of cut-off machine . . . rubber-bonded wheels for wet operations, resinoid-bonded wheels for dry. Constant rigid laboratory inspection of

raw materials . . . modern ovens with delicately-set temperature regulators . . . and other factory refinements contribute to the mounting reputation for leadership of Bay State "Blue Flash" cut-off wheels just as they do for Bay State's complete line including all types of grinding wheels and other molded abrasive products. Bay State's reputation for honing and superfinishing stones is unexcelled.

Test a wheel to see how Bay State quality helps "green hands" and veterans too. For additional details get Bay State's Cut-off Bulletin. Write . . .

**BAY STATE ABRASIVE PRODUCTS CO.**

**WESTBORO, MASS.**



## BLUE **Z** FLASH GRINDING WHEELS *FAST and COOL*



GRINDING WHEELS



HONING AND SUPERFINISHING STONES



PORTABLE SNAGGING WHEELS

MOUNTED WHEELS



AND POINTS



CUT-OFF WHEELS



INSERTED-NUT DISCS



AND CYLINDERS



# STRENGTH WANTED? *Then Use* **COLUMBIAN CO-RO-LITE** *Fibre Fillers*

*Get...*

1. impact strength on a par with laminates
2. wide range of density
3. wide range of molding shapes
4. distinctive natural texture
5. combined rigidity and elasticity in the same piece.



★ More and more—as this war goes on—you're going to need fillers that will give you high impact strength combined with a wide range of molding shapes. So why not start now with

COLUMBIAN CO-RO-LITE, the resin-impregnated thermosetting batting that is made from light, tough cordage fibres—needled into a cohesive mass. It comes to you ready for shaping, molding and setting—with density and specific gravity adjusted to your own specifications in the raw sheets.

Use flash molds if you wish. Produce either sheets or molded shapes, suitable for impact, bearing, tension or compression parts. No softening point. No cold flow under reasonable loads. No effect on metal inserts. Its mechanical and dielectric properties improve with age. Due to its ability to combine both rigidity and elasticity in the same piece, CO-RO-LITE is ideal for forming solid hubs with flexible peripheries.

Write or wire for physical data and production recommendations.

Patent No. 2,249,888  
Other patents pending

ALLIED  
PRODUCTS  
DIVISION

## COLUMBIAN ROPE COMPANY

400-10 Genesee St.

Auburn, "The Cordage City" New York

# Crystal clarity, *plus* chemical resistance ...in Plexiglas



PLEXIGLAS valve parts used in the Chem-O-Feeder, designed and built by Proportioneers, Inc., to supply accurately measured quantities of water-treating chemicals to a stream of liquid. Parts are injection molded (by Firestone Rubber & Latex Products Company, Fall River, Mass.) in a single-step operation—molded to final shape and dimensions without subsequent machining.

These outstanding features are among the reasons why Proportioneers, Inc., selected PLEXIGLAS for the valve parts on its widely used chemical feeder:

**Resistance to chemicals, especially the solutions used in water treatment.**

**Lasting transparency, to permit quick visual inspection.**

**Ease of molding into finished parts, complete with assembly threads and flanges.**

**Dimensional stability and low water absorption.**

Add to these advantages such other features as light weight, high impact strength, resistance to weathering, permanent electrical properties...and you may see many ways in which "Aviation's Standard Transparent Plastic" will fit into your own war production—or post-war plans.

For technical assistance in using PLEXIGLAS to best advantage, call our nearest office: Philadelphia, Los Angeles, Detroit, Chicago, Cleveland, New York. Canadian Distributor: Hobbs Glass Ltd., Montreal.



3 awards to Rohm & Haas Company and its associated firms, The Resinous Products & Chemical Company and Charles Lennig & Company.

*Only Rohm & Haas makes*

## PLEXIGLAS

CRYSTAL-CLEAR ACRYLIC SHEETS,  
RODS AND MOLDING POWDERS\*

\*Formerly CRYSTALITE Molding Powders

PLEXIGLAS is the trade-mark, Reg. U. S. Pat. Off., for the acrylic resin thermoplastic sheets, rods and molding powders manufactured by Rohm & Haas Company

# ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries





## A MARK OF DISTINCTION IN PLASTICS AND HARD RUBBER

Behind the mold mark of the Jos. Stokes Rubber Co.—a trademark found on increasing thousands of hard rubber and plastics parts—lies half a century of experience. It is knowledge that is yours to command whenever you will—knowledge backed by modern research facilities, extensive manufacturing equipment, and a willingness to analyze and share your problems from the idea stage to the finished product. We are ready to talk over either your present or your post-war plans.

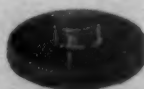
**JOS. STOKES RUBBER CO.**

Molders of Plastics and Hard Rubber

*Established 1897*

**TRENTON, N. J.**

In Canada: Jos. STOKES RUBBER Co., Ltd., WELLAND, ONT.



# What is the main "point" in a LABORATORY MILL?

A mill for use in a laboratory must be a versatile piece of equipment . . . a machine that can be used for a certain series of tests or experiments today, and for a totally different purpose tomorrow or the week after.

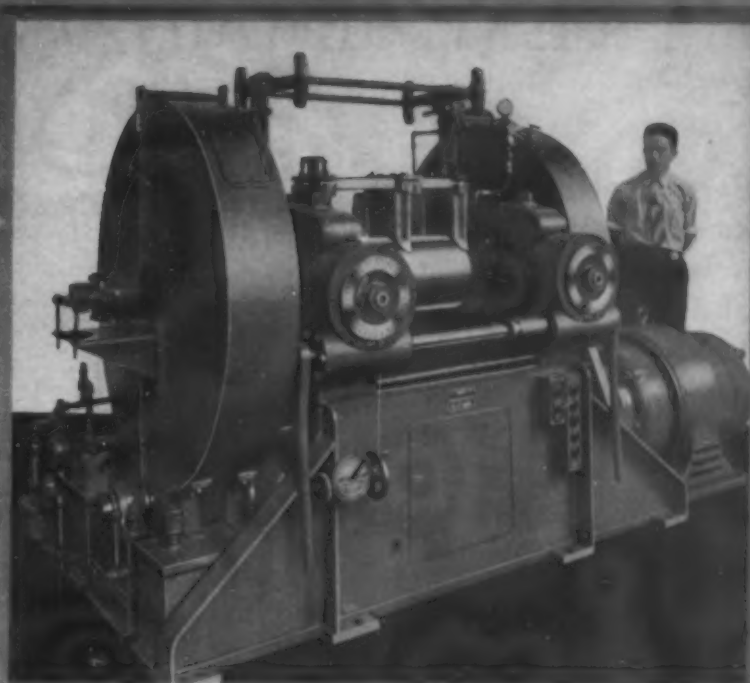
For this reason, we ask each purchaser to tell us what he wants to accomplish, so that we can furnish a mill built to meet his individual requirements. This may be a standard mill, a modification of a standard mill, or an entirely new design . . . depending on the job to be done. Three examples of laboratory mills, "designed for the job," are illustrated on this page.

Before you decide on a laboratory mill, we suggest you ask our engineers for recommendations and get the benefit of their experience.

**FARREL-BIRMINGHAM COMPANY, INC.**  
ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.

Sales Offices: Ansonia, Buffalo, New York,  
Pittsburgh, Akron, Los Angeles



**1** 12" x 26" double-g geared mill driven by a four-speed, AC motor through a speed changer which provides infinitely adjustable roll friction from even motion to 2:1 friction. A worm and ratchet mechanism facilitates adjustment of the front roll, and vernier indicators show amount of roll movement. Removable center guide, adjustable along the roll face, makes milling of varying size batches easier. Hand-operated scraper can be changed from front to back roll. Push-button control on both sides of mill permits operation from either side.

**2** 10" x 24" mill mounted on welded base which provides convenient working height. The DC, adjustable-speed, geared motor drive is housed in the base. A worm and ratchet device with clutch permits synchronized adjustment of both ends of front roll or either end separately. Knives are provided for trimming edges of the stock. A take-off roll, mounted between the housings, facilitates stock removal.



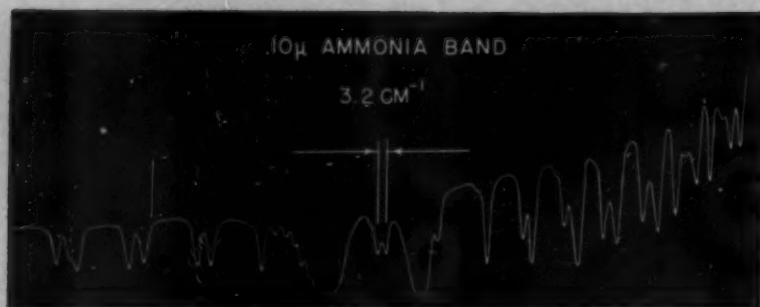
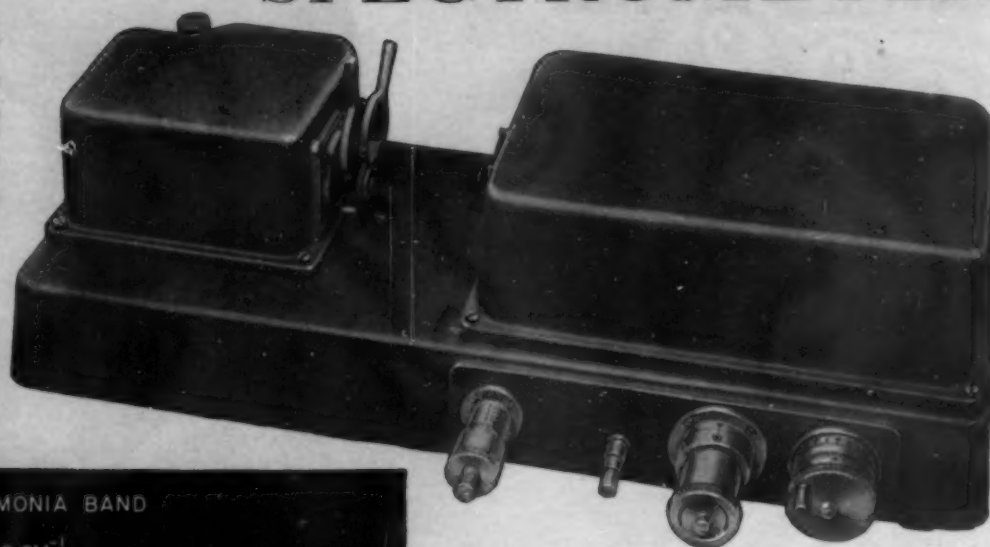
**3** 8" x 16" mill with geared motor drive enclosed in high base of welded construction. This arrangement conserves floor space and provides ready access to the mill from all sides.



## Farrel-Birmingham

# A NEW all-purpose INFRARED SPECTROMETER

For identifying unknown organic materials, determining characteristic atomic groups and analyzing complex chemical mixtures.



## Basic Facts About Infrared Spectroscopy

THE APPLICATION of infrared spectroscopy to chemical problems is today a necessity for the chemical industry. Its usefulness in this war-emergency is recognized in such diversified industries as petroleum, rubber, plastics, explosive intermediates, biochemicals, etc.

The value of this new technique lies in the fact that almost all materials exhibit characteristic absorptions in the infrared analogous to the phenomenon by which colored materials show absorption in the visible region of the spectrum. These absorptions, arising from the atomic configurations of the material, are unique for each substance and may be regarded as identifying characteristics similar to boiling point, melting point, or index of refraction. However, the infrared method has the advantage over other methods in that it offers a multiplicity of unique constants. These absorption bands have a twofold use—their wave length values offer a "fingerprint" method for identifying characteristic atomic groups or for matching unknowns, while the absorption intensity is the basis for a quick, accurate, standardized method for analyzing multi-component mixtures.

In order to make this new tool available to industry, The Perkin-Elmer Corporation has developed a simply operated, all-purpose infrared spectrometer which may be used in either laboratory research or production control problems.

## DESIGN FEATURES

- Compact (12" x 31" x 9" high), sturdy design; airtight covers to permit elimination of atmospheric interference.
- Optical speed  $f/4.5$ ; 60° prism face 60 x 75 mm.; off-axis parabolic collimation. Sufficient resolution for the majority of industrial applications. (See above curve, recorded with double galvanometer amplifying system).
- Arrangements for gas, liquid, or solid sample studies; vapor path up to 50 cm. available for low concentration work.
- Continuous wave length adjustment over easily legible scale of 2000 divisions; provisions for motor drive if automatic recording is desired.
- Adjustable turret mechanism to allow rapid selection of predetermined wave lengths for routine analyses.
- Accurate, bilateral, simultaneously operated, adjustable slit mechanism with curved jaws to ensure resolution.
- Simple prism mounting to permit interchange of prisms for special work.
- Especially designed Globar source and mounting.
- Electrical output sufficient for single galvanometer recordings.
- Automatic, adjustable temperature compensation.
- Grouped controls.



## THE PERKIN-ELMER CORPORATION

GLENBROOK · CONN.

# D R This is Not a New Motor

... *But* — this is the first time we have advertised our TYPE OG standard open squirrel cage motor.

*These motors have been giving a splendid account of themselves in the war program for over two years.*

A complete line is available— $\frac{3}{4}$  to 100 HP in D.C. and  $\frac{1}{2}$  to 500 HP in A.C.

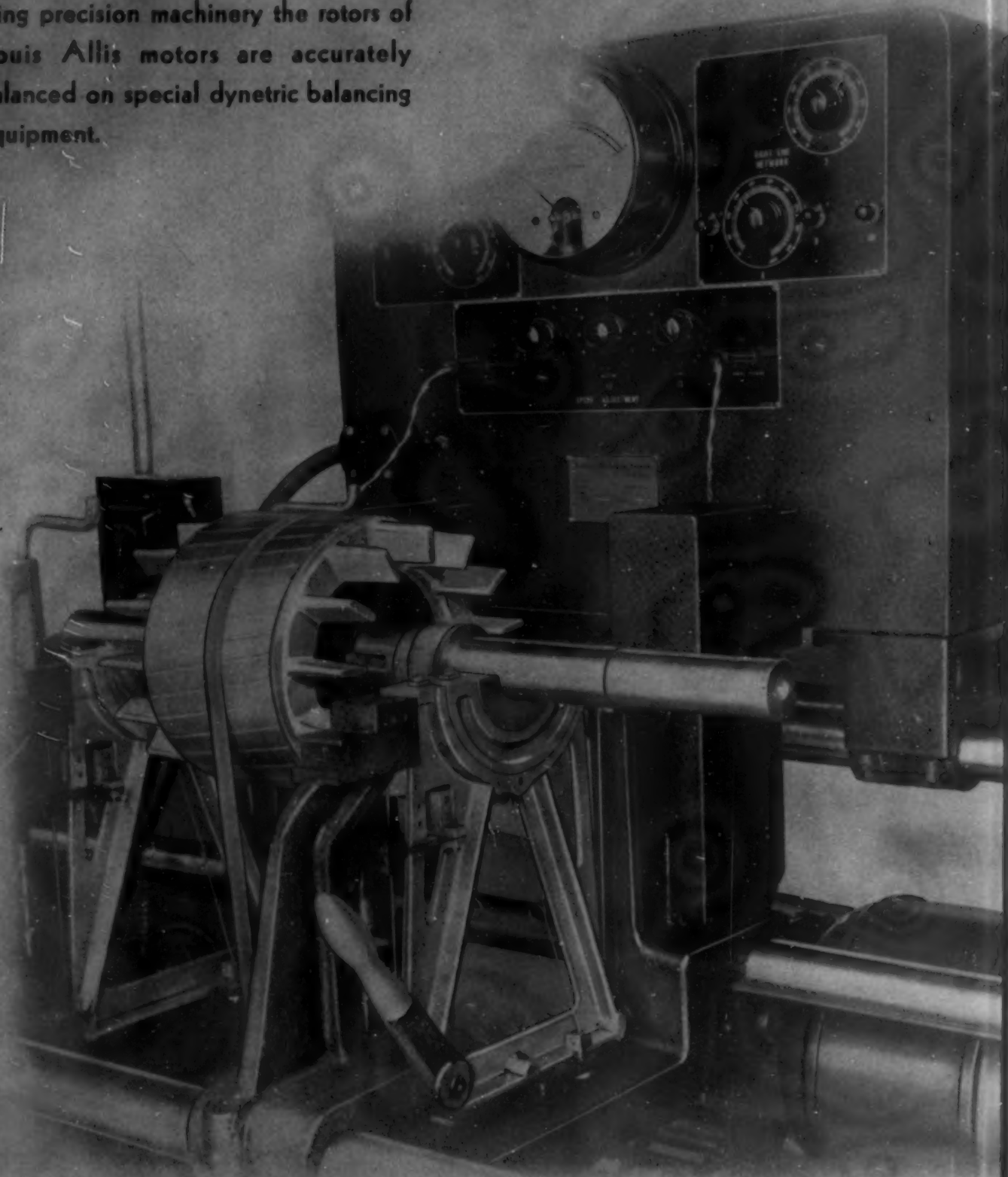
A copy of our new bulletin fully describing the quality features of TYPE OG motors will be sent upon request.



THE LOUIS ALLIS CO., MILWAUKEE 7, WIS.

## *Balance*

To assure the perfect mechanical balance that is required for smooth operating precision machinery the rotors of Louis Allis motors are accurately balanced on special dynetric balancing equipment.



**THE LOUIS ALLIS CO., MILWAUKEE 7, WIS.**

CE



**STANDARD RESINS** now available  
for **IMMEDIATE DELIVERY**



By drum or tank car...

# THE RESIN YOU NEED IS READY TO SHIP\*



**I**N THE TIME that C.P.C. has been developing specification resins for leading industrial users (in the plywood, mineral wool, airplane propeller and other industries), a score of C.P.C. Resins have now become the accepted, *standard* resins for specific application in those and other industries.

Volume production of these standard C.P.C. resins has been so stabilized (held within such extremely close range of variation) that the performance of *every shipment delivered can be depended on to be identical with the first.*

**HOW TO GET A BETTER RESIN.** Draw freely upon the knowledge and wide experience of C.P.C. We will gladly work with you on any resin problem; we will develop a new resin should your application require it; or discuss with you the possible advantage of using resins in a new operation or process. Write Central Process Corporation, 1401 Circle Avenue, Forest Park, Illinois.

\*Orders must qualify under WPB General Preference Order M-246. Limited experimental quantities available without allocation. A copy of complete regulations sent on request.

## TYPICAL APPLICATIONS for C.P.C. Standard Resins

- Impregnating Wood
- Bonding Plywood
- Joint-Gluing and Assembling
- Compounding Lignin Molding Materials
- Laminating Paper, Fabric, etc.
- Bonding Mineral Wool Bats, Boards, etc.
- Accreting Fibre Shapes
- Rapid Setting Castings
- Cementing Wood, Plastics, Brush Bristles, Rubber and Metal

CENTRAL PROCESS CORPORATION • FOREST PARK, ILLINOIS



U. S. Army's Heavy 60-ton tank  
Photo by U. S. Army Signal Corps

**W**HILE it would be a mistake to put aside important war work, yet even as with the governments of our country and our allies, it is necessary **NOW** to spend some time on post-war plans and products. Industry must be ready when the time comes to absorb millions of our returning heroes.

What is the status of **YOUR** post-war plans? **ARE YOU READY**..will you be among the first to hit the market between the eyes with a product that fits the future? Will **YOU** survive the *new* competition in *your* field, created

by the reconversion of vast war plants to producing the products of peace?

Sinko plastic engineers are eminently fitted with ingenuity, skill and long experience to lend you effective aid in applying all the beauty, color, and strength of economical **THERMO-PLASTICS** to your products. Let them study your post-war plans.. help you **NOW** through the drawing board stage. Be ready to act quickly ..to get the jump on competition the moment we get the signal to **GO AHEAD!**



**SINKO TOOL & MANUFACTURING COMPANY, 351 NO. CRAWFORD AVENUE, CHICAGO, ILLINOIS**

REPRESENTATIVES: L. D. MOORE, 4030 CHOUTEAU AVE., ST. LOUIS, MO. • POTTER & DUGAN, INC., 29 WILKESON ST., BUFFALO, N. Y. • ARCH MASON, 259 CENTRAL AVE., ROCHESTER, N. Y. • H. O. ANDERSON, 202 HERALD BLDG., SYRACUSE, N. Y. • PAUL SEILER, 7779 CORTLAND AVE., DETROIT, MICH. • QUEISSER BROS., 108 EAST NINTH ST., INDIANAPOLIS, IND.





## WHEN YOU AND FORMICA ARE HONORABLY DISCHARGED

### YOU'LL WANT THIS VETERAN IN YOUR PEACETIME PRODUCT

Formica laminated plastic is 30 years young, but a veteran with a long bright future before it helping you make better products for a better world. It passed the most rigid "physical" when it entered the armed services. It is serving in every branch on land, sea and in the air. It went through all the hells on all the fronts as parts of vehicles, planes, tanks, ships and communications equipment. It is coming back to you laden with stripes.

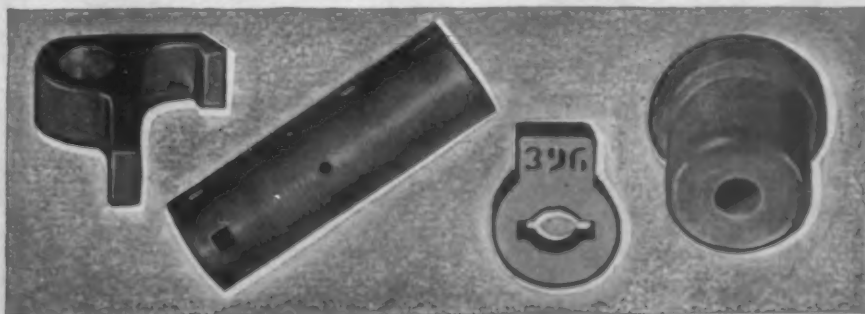
It has met the severest tests in the most gruelling

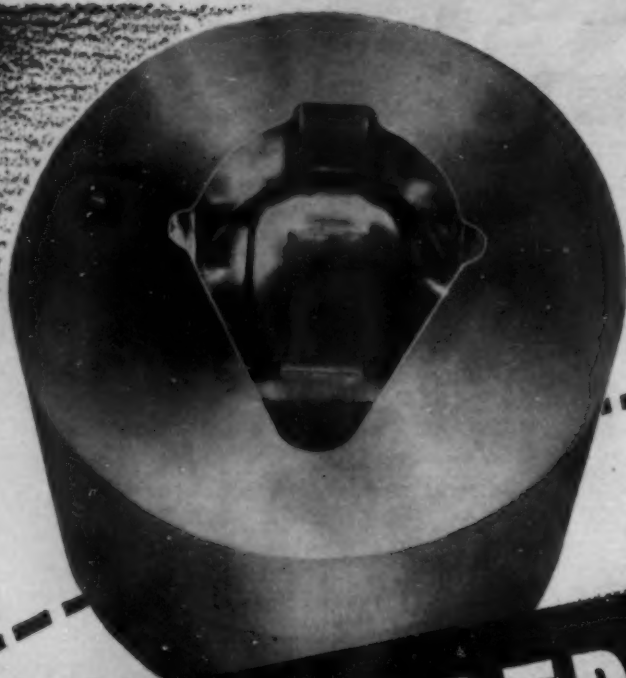
combat to which men and materials have ever been subjected.

It is light for its great strength, non absorbent, acid resistant, and has good dielectric properties, machinability, and comes in many grades with special properties. Why not investigate its applicability to your post war product now.

"The Formica Story" is a moving picture in color showing the qualities of Formica, how it is made, how it is used. Available for meetings of engineers and executives.

THE FORMICA INSULATION COMPANY, 4673 SPRING GROVE AVENUE, CINCINNATI 32, OHIO.





# A HOBBED CAVITY

## ...FIRST STEP TO QUALITY

When it comes to finish, accuracy and speed of production, the advantages are all with the hobbled cavity.

When it comes to experience, "know-how" and facilities for producing hobbled cavities, the experience of leading molders in all parts of the country points to Midland Die & Engraving Company as a preferred source.

The new brochure, "Shaping Tomorrow Today" explains the vital part in plastics played by the hobbled cavity. Every designer, molder and manufacturer should have a copy—

WRITE FOR YOURS—TODAY!

Hobbed Cavities  
by Midland...



### MIDLAND DIE AND ENGRAVING COMPANY

1800 W. BERENICE AVENUE • • • CHICAGO 13, ILLINOIS

Makers of Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps • Hobbings • Pantograph Engraving



# **BAKER** **PLASTICIZERS**

for:

- I. Low Temperature Flexibility
- II. Retained Flexibility

Baker Plasticizers Contain No Phthalate

**The**  
**BAKER CASTOR OIL COMPANY**

*Established 1857*

120 Broadway, New York 5, New York

Jersey City, New Jersey

Los Angeles, California

Bayonne, New Jersey

# plastics TESTING

In Preparation for the World of Plastics to Come

The tremendous capital investment in plants producing Plastics for the war will have to draw dividends after victory. That means that the entire productive capacity of the Plastics Industry will be adapted to civilian manufacture. ★ How shall you convert your plant? What shall you make? Where can you sell it? Scientific Testing and Research have the answers. ★ The following are our routine Plastics Tests meeting present practical problems of production. We are also available for consultation and research in the problems of tomorrow.

## PLASTICS TESTS

STRENGTH	Per Sample
Impact Charpy or Izod .....	5 Specimens \$ 5.00
Tensile .....	5 Specimens 7.50
A. With Stress Strain Diagram .....	5 Specimens 12.00
Flexural .....	5 Specimens 7.50
A. With Stress Strain Diagram .....	5 Specimens 12.00
Compressive .....	5 Specimens 7.50
A. With Stress Strain Diagram .....	5 Specimens 12.00
BONDING STRENGTH .....	5 Specimens 7.50
BEARING TEST .....	5 Specimens 7.50
SHEAR TEST (Johnson Shear Tool) .....	5 Specimens 5.00
ROCKWELL HARDNESS .....	5 Specimens 2.00
THICKNESS .....	5 Specimens 1.00
DENSITY .....	2.00
DISTORTION UNDER HEAT .....	6.00
SPECIFIC HEAT .....	3.00
THERMAL EXPANSION .....	5.00
FLAMMABILITY .....	3.00
COLOR FASTNESS .....	5.00
RESISTANCE TO CHEMICAL REAGENTS (15 Reagents) .....	45.00
ACETONE EXTRACTION .....	5.00
HOT OIL TEST .....	3.00
WATER ABSORPTION IN 2 AND 24 HOURS .....	5.00
DIELECTRIC STRENGTH	
Short Time .....	6.00
Step by Step .....	10.00
POWER FACTOR AND DIELECTRIC CONSTANT AT 60 CYCLES	
10 <sup>5</sup> or 10 <sup>6</sup> Cycles per Frequency .....	15.00
2nd Sample .....	12.50
Each Additional Sample .....	10.00
VOLUME RESISTIVITY—INSULATION RESISTANCE .....	5.00
THERMAL CONDUCTIVITY (Mean Temperature 80° F.) .....	25.00
MOLD SHRINKAGE .....	15.00
COST OF MACHINING AND PREPARING SAMPLES	
Rate per Hour .....	1.75
ARC RESISTANCE .....	6.00

The cost of molding test specimens will depend on the tests required and is based on a rate of \$2.00 per hour.

NOTE: The per sample charge on the first twelve items includes five specimens on each test. Charges are for one direction only.

Member of American Council of Commercial Laboratories

UNITED STATES TESTING COMPANY, INC.

ESTABLISHED 1880

HOBOKEN, NEW JERSEY

PHILADELPHIA, PA.

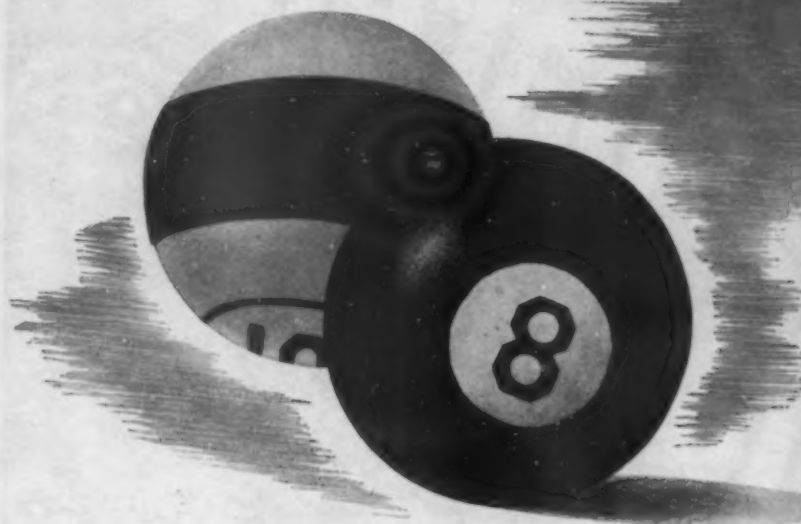
WOONSOCKET, R. I.

CHICAGO, ILL.

NEW YORK, N. Y.



# WHY IS NITROCELLULOSE THE PLASTIC USED FOR BILLIARD BALLS?



WON'T MAR OR CHIP—TOUGHEST  
OF ALL THERMOPLASTICS

BALLS STAY SPHERICAL—WILL  
NOT WARP, SHRINK, OR SWELL

EXCELLENT RESISTANCE  
TO PERSPIRATION

WIDE RANGE OF FADE-  
PROOF COLORS

LOW IN COST

## ALL THESE ADVANTAGES IN ONE LOW-COST PLASTIC



**SO TOUGH**  
it is used to make billiard balls.  
(Toughest of all thermoplastics.)



**SO BEAUTIFUL**  
in finish it is used to make luminous pearls.



**SO EASILY FABRICATED**  
by drilling, punching, sawing, turning,  
... can even be printed and polished.



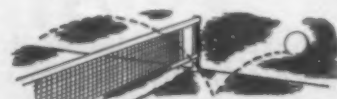
**SO RESISTANT TO CHEMICALS**  
it is used to make storage battery casings.



**SO STABLE**  
dimensionally (will not warp, swell,  
shrink) is used for drawing instruments.



**SO UNLIMITED IN COLOR**  
possibilities—pastels, vivid opaques,  
tinted transparencies, and pearl effects.



**SO RESILIENT**  
it is the standard for ping-pong balls.



**SO CLEAR**  
it is used for identification card windows.



**SO LOW IN COST**  
it is used to make thousands of beautiful,  
inexpensive trinkets and novelties.

**HERCULES POWDER COMPANY**  
INCORPORATED

916 Market Street

Wilmington 99, Delaware

CP-42

## FREE check chart

Includes helpful information on the  
uses and technical characteristics of  
nitrocellulose plastics. Write today  
for your free copy.



Have you looked into  
**transparent  
plastics?**

WE'RE talking about acrylics, methyl methacrylate, acetates (plexiglas, vinylite, lucite, plastacele, lumarith, et al), which have a transparency worth your looking into. Instrument dial windows and faces,

cowlings, shields, tubes, cylinders and numerous other applications requiring light transmission or specific electronic properties—have been some of our fabricating assignments

since concentrating on war production. As fabricators we are prepared to help you develop and produce a large variety of items to your specifications. Our experience is extensive, our equipment versatile, our personnel adept. Our products will pass inspection for close precision work, and will meet your delivery requirements.

★ If you have any plastic items to be fabricated consult us without obligation. Our entire production is devoted to war work. We will welcome your inquiries.



**Back the Attack**  
**Buy More Than Be4**  
**5th War Loan**

**dura plastics, inc.**

1 west 34 street, new york 1, n. y.

*Custom fabricating specialists to the aviation, electronic and shipbuilding industries.*

## FASTEN PLASTICS WITH ALUMINUM



*Send for this new catalog . . . it's Free*

Standard aluminum fastening devices, manufactured by Alcoa in various alloys of Alcoa Aluminum, meet the rigid requirements desirable in assembling plastic products. A high degree of precision is maintained. They contribute security, light weight, ease of handling, fine appearance and corrosion resistance.

Strong aluminum alloy screws, bolts, nuts and rivets make dependable fastening devices; witness the aircraft using millions of them daily. Include these items in your designs and gain the security which comes from fastening plastics

with aluminum, and the economies obtained by standardization.

Alcoa standard screw products are now available in all needed types, sizes and finishes. "Stock" items are carried in warehouse stocks, strategically located throughout the country, by all authorized Alcoa distributors. Where special parts are required, manufacturing facilities are available for producing them.

For a copy of this new catalog, write ALUMINUM COMPANY OF AMERICA, 2175 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA  ALUMINUM

# TEXTILE FABRICS FOR PLASTIC LAMINATES

The 20 mills in the Deering Milliken group, with nearly a million spindles and 25,000 looms, produce a wide variety of cotton and synthetic fabrics. Our facilities and knowledge of textiles are at the service of the plastics industry.



**DEERING MILLIKEN & COMPANY**

INCORPORATED

240 CHURCH STREET, NEW YORK 13, N. Y.

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# BAKELITE

TRADE-MARK



## This Sensitive, Sturdy Army Tank Compass *points the way to improved product design*



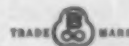
If you are a manufacturer or product design engineer, your product may be totally unlike this Sherrill tank compass in design or function; yet they may have a lot in common. Does your product require fine adjustment? Must it retain accuracy under extremes of temperature conditions? Is it of complex design? Are such properties as shock resistance, high di-

electric strength, dimensional stability, and lasting surface finish essential?

Manufacturers of the Sherrill compass found the answer to these multiple requirements in one material—a BAKELITE impact-resistant phenolic plastic. This material is used for 23 vital parts, comprising 70 per cent of the compass assembly. Each part was formed rapidly in a single molding operation, avoiding costly and time-consuming machining operations.

There are many types and forms of BAKELITE plastics. Investigate now the possibilities they offer for today's essential production and for the improved products of tomorrow.

Write Department 15-M for a copy of "Bakelite Molding Plastics".



BAKELITE CORPORATION  
Unit of Union Carbide and Carbon Corporation



30 EAST 42ND STREET, NEW YORK 17, N.Y.

Molder: Michigan Molded Plastics, Inc.

# PLASTICS

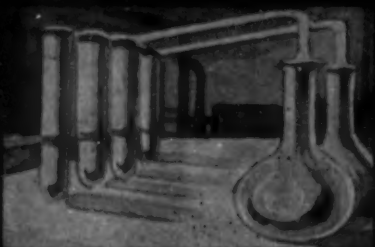
# Reasons Why!

Reynolds Is Outstanding  
In Molded Plastics



## ENGINEERING

Experienced technicians engineer your ideas all the way, through design, molds and complete finish—by compression, injection, extrusion or sheet forming.



## RESEARCH

Long tested and proved the Reynolds organization is always deep in research—development—planning—for post-war needs and rapid reconversion.



## FACILITIES

Plastic Molding by Reynolds means far more than just buildings, machinery, labor and material. It also means resourcefulness and intelligent ingenuity that will serve you well.

# REYNOLDS

## MOLDED PLASTICS

C A M B R I D G E , O H I O

INVEST IN WAR BONDS

22 YEARS

20

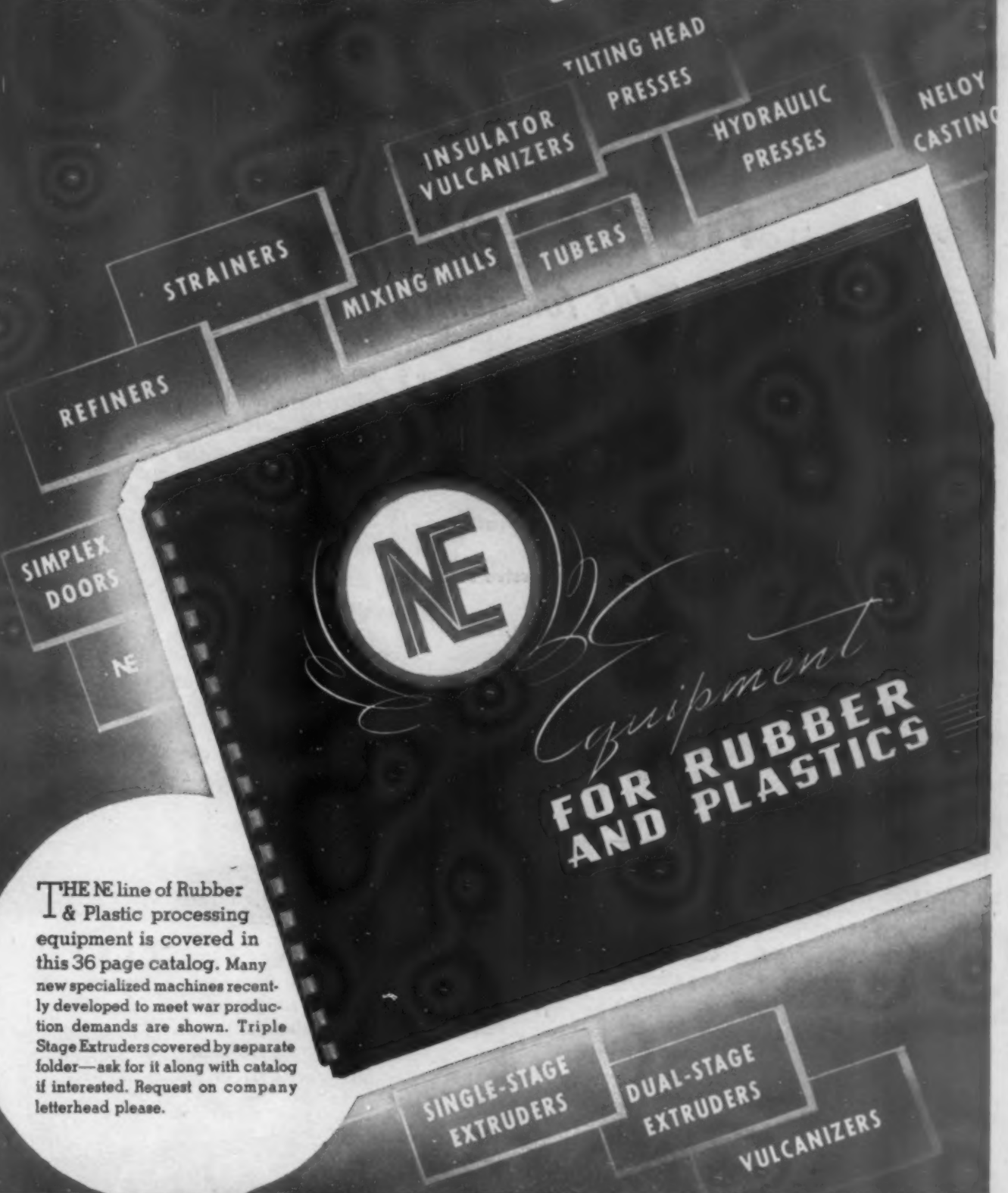
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DIV. OF REYNOLDS SPRING CO.  
JACKSON, MICHIGAN

# WRITE FOR THIS *New* CATALOG



THE NE line of Rubber & Plastic processing equipment is covered in this 36 page catalog. Many new specialized machines recently developed to meet war production demands are shown. Triple Stage Extruders covered by separate folder—ask for it along with catalog if interested. Request on company letterhead please.

**NATIONAL ERIE**

*Erie, Pa.*



**CORPORATION**

*U. S. A.*

## And NOW— **FIBERGLAS\*** *opens up* *New fields for Reinforced Plastics*

Product designers and engineers in many fields will be interested in the results of using Fiberglas Textiles for reinforcement of plastics in aircraft.

Test results show that Fiberglas Reinforced Plastics have the following important properties and characteristics:

- ★ High strength-to-weight ratio,
- ★ High impact strength,
- ★ High edgewise compressive strength,
- ★ Dimensional stability,
- ★ Low moisture absorption,
- ★ High heat resistance,
- ★ Ease of fabrication into complex surfaces and shapes, and
- ★ Ready machining of laminated parts.

For further data, write or call the branch office nearest you. *Owens-Corning Fiberglas Corporation, Toledo 1, Ohio. Fiberglas Canada, Ltd., Oshawa, Ont.*

# FIBERGLAS

\*T. M. Reg. U.S. Pat. Off.



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**... Uniform Weaving Aids Uniform Molding**

*Specify*

**MT. VERNON  
EXTRA**

In the low pressure molding of laminates where fabrics are used, fabric uniformity plays an extremely important role. For highly uniform fabrics encourage the deep and complete penetration of resins and help to avoid stratification. In the case of MT. VERNON Extra you will find this characteristic developed to an exceedingly high degree. These superior industrial fabrics are woven to rigid standards of tolerances . . . their whole production being guided by a broad system of laboratory control. Where fabrics uniformity counts . . . and it does in the making of successful laminates . . . specify MT. VERNON Extra.

**MT. VERNON  
WOODBERRY  
MILLS, INC.**

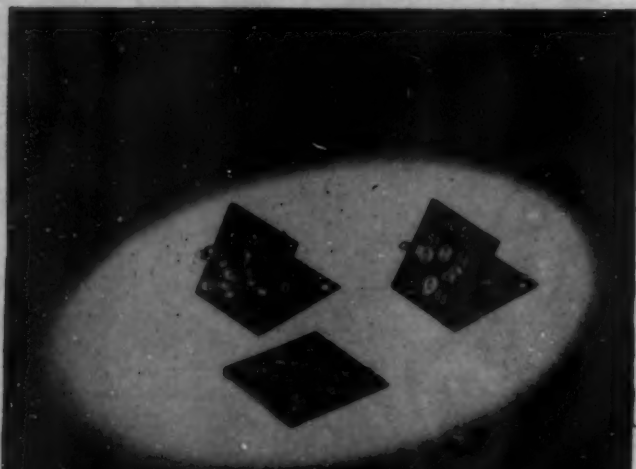
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# NO LIMIT TO CALLS—IN JAP WRECKAGE



Parts of National Vulcanized Fibre and Phenolite, laminated Bakelite are used widely in communication instruments of every description. This is because of their great dielectric strength, lightness in weight and exceptional wearing qualities.

**T**HE ruins of shattered Jap buildings on captured Namur lay around these Marine Signalmen as they hurriedly set up communications. There's no limit to calls here—the advance moves on—thanks to the skill of our signalmen and the high efficiency of our communications equipment. Important in the dependable operation of these instruments are the countless parts made of plastics like National Vulcanized Fibre and Phenolite, laminated Bakelite.

The electronic engineers of America are doing a great job at the battle front—and on the home front.



**NATIONAL VULCANIZED FIBRE CO**

WILMINGTON



DELAWARE

Offices in

Principal Cities



# MAKE 2 PRESSES DO THE WORK OF 3

## WITH THIS NEW RCA ELECTRONIC PREHEATER

**H**ERE'S a new automatic electronic unit — the RCA Model 2-B — designed specially for the plastics industry to speed the preheating of preforms and increase press output.

**Easy to Operate:** The 2-B is as automatic as your toaster ... just set the preform on a plate, close the protective cover, and press the START button. In a few seconds time, the preform is softened *all the way through*, the power goes off, and the cover opens.

**Increased Press Output:** Because electronic preheating provides *complete* softening, press closing is speeded up (in one typical case by 77%), curing time in the mold is cut down (in this case by 79%), mold stresses are greatly reduced, and product quality is improved both chemically and mechanically. As an average, *two presses will do the work of three!*

**High Speed:** The new RCA 2-B gives you not only the speed of electronic heat, but in addition, an ingenious electronic compensator that keeps the heating rate at a maximum in spite of chemical changes in the preform. The 2-B will heat one-pound of preformed material to 275°F. *all the way through* in 60 seconds.



**Write Today:** RCA electronic generators are available on priority. Write today for Engineering Data Form P—a simple way of telling us your needs—and for further information on RCA electronic generators. Use the coupon, or write to RCA, Electronic Apparatus Section, Camden, New Jersey.



RCA ELECTRONIC HEAT  
RADIO CORPORATION  
OF AMERICA



BUY MORE WAR BONDS

(Please Check)

- ☐ "Engineering Data Form P"—a quick way to tell us your needs
- ☐ Bulletin on "RCA Electronic Generator Model 2B"
- ☐ "Electronic Heat Speeds Plastic Molding"—a semi-technical article on electronic heating

RCA, Electronic Apparatus Sec., Camden, N. J.  
Gentlemen: Please send the items checked to:

Name.....

Company.....

Address.....

City..... State.....

TG-38A



# PLASTICS

## *Development and Engineering*

Critical plastics problems have been worked out in our laboratories during recent months for universities, war contractors, aircraft manufacturers, and plastics molders. The plastics knowledge and experience of our Research Staff, as well as the ASTM testing equipment maintained here, is available to anyone with plastics problems encountered in war or postwar plans.

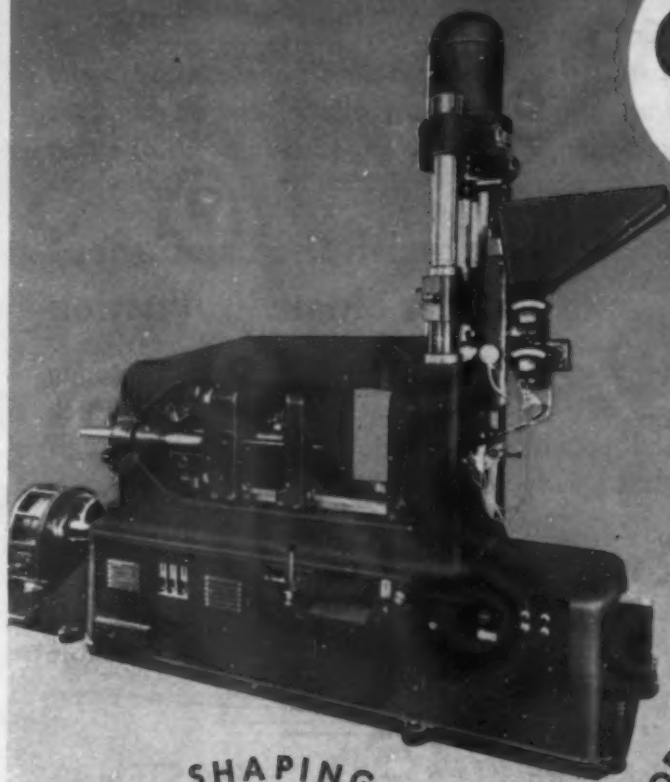
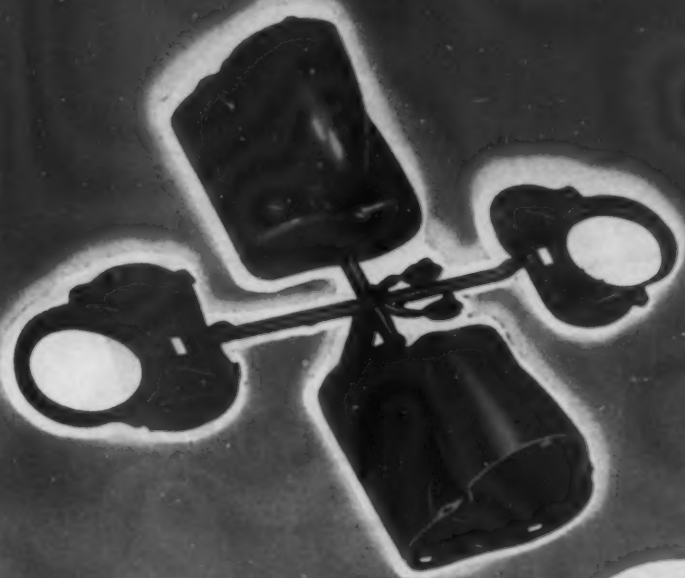
*Inquiries are cordially invited.*

*Plastics*  
**INDUSTRIES TECHNICAL INSTITUTE**

*Research for Testing Laboratories*

Dept. MP-6, 186 S. Alvarado Street, Los Angeles 4, California

# Preview of a Postwar Product



SHAPING THE THINGS OF TOMORROW

# LESTER

## INJECTION MOLDING MACHINES

National Distributors: **LESTER-PHOENIX INC.**

2711 CHURCH AVENUE  
CLEVELAND, OHIO

Here's one postwar story that can be told . . . because it started in the prewar period. The Sterling Plastics Company of Union, New Jersey, made over 2,000,000 housings for the trim and colorful Ristlite on an 8-ounce Lester injection molding machine . . . without a single production delay resulting from machine failure. And today, tomorrow or the next day . . . Sterling's Lester will be ready to double and triple its past record.

Look at the intricate, multiple-cavity, cellulose acetate molding at the left. Thin sections and precision assembly requirements combine to make a difficult job for high-speed automatic injection. Yet the Lester machine turned it out of the mold just as you see it, clean and flawless, at the rate of 200,000 complete housings per month and at a cost which was low by any comparison.

Is *your* postwar molding problem as tough as this? Or tougher? Consult Lester.

### What's New?

Our Model 3V-12, of course! Write for free information on the machine which combines all three major molding processes.

### These are LESTER EXCLUSIVES!

- ① VERTICAL HEATING CYLINDER with hollow injection plunger delivers more material at higher pressure per energy input.
- ② EXTRA INTERCHANGEABLE HEATING CYLINDERS greatly expand operating range.
- ③ POSITIVE DIE LOCKING virtually eliminates flash.
- ④ CENTRAL DIE ADJUSTMENT assures constant and absolute parallelism of die plates under all conditions.
- ⑤ MASSIVE "CHROME-MOLY" STEEL BEAM FRAME give 3 to 5 times strength and rigidity afforded by conventional bar construction.
- ⑥ COMPLETE SIZE RANGE—4, 6, 8, 12, 16 and 22-ounce models.

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## A New Name for a Very Old Yankee Manufacturer

### WATERBURY COMPANIES, INC.

**KNOWN** for many years as The Waterbury Button Company, this 132 year old Connecticut manufacturer has changed its name to Waterbury Companies, Inc. While button manufacturing is and will continue to be a division of this Company, it is nevertheless but one of six separate divisions manufacturing a great diversity of products. Time and change have brought about a need for a new name.



**PLASTIC MOLDING  
PLASTIC  
LIGHTING FIXTURES  
METAL SUNDRIES  
EYELETS  
UNIFORM & DRESS  
BUTTONS**

**Our Engineers and  
Designers will work  
with you**

### A Modern Plant with the Equipment and Facilities for Volume Production

Today Waterbury Companies, Inc., is manufacturing thousands of plastic and metal products, most of which are identified with the war effort. Its modern and efficient plant is fully equipped for volume production.

Although largely engaged in essential war work, we are thinking about reconversion to peacetime production. Our engineers and designers will gladly plan with firms who are looking for a dependable source of plastic and metal products.

**BUY MORE  
WAR BONDS**



**HASTEN  
VICTORY**

# WATERBURY COMPANIES, INC.

Established 1812 • Department B  
WATERBURY • CONNECTICUT

## PROBLEM: Valve Wheels

Must replace all-metal wheels, 5" to 24" diameter. Must incorporate metal hub, operate without failure under heavy torque, stand up under extreme temperatures and corrosive conditions.



Don't think of Kys-ite as simply a replacement for metal! This remarkable thermo-setting plastic has features combined in no other type of material—features that may well be just what you are looking for. Check the list at the right against your product specifications.

THIS MONTH—BUY WAR BONDS

# KEYES

MOLDED PRODUCTS

As completed war contracts release our manufacturing facilities, we will again be able to custom mold to your specifications.

Production is now being scheduled as orders are placed. May we suggest you contact us promptly?

## SOLUTION:

# KYS-ITE

the long-fibred wood pulp-filled phenolic resin plastic, preformed before curing.

### GREAT STRENGTH WITH LIGHT WEIGHT.

One of the most important features of the Kys-ite process is the development of the molded shape in its original form before curing. This means that however irregular the shape, there are no stresses and strains set up at the time the article is cured. An even impregnation of phenolic resin on interlocking fibres results in great tensile and compressive strength and an impact strength 4 to 5 times that of ordinary plastics.

**DURABILITY.** Stands up under the severest service conditions. Resists abrasion, chipping, denting, cracking and wear to an extraordinary degree. Kys-ite articles can "take it!"

**NON-CORRODING.** Impervious to grease, brine, alcohol, oil, gasoline, ordinary acids and alkalis. In Government supervised tests Kys-ite articles were boiled 14 days in solutions of soap, sodium hydroxide and 4% acetic acid without the slightest damage.

**HIGH EYE APPEAL.** Wide range of beautiful rich colors, smooth lustrous finish. Hard to damage because color and finish are integral with the material. Many different kinds of decoration can be permanently incorporated. Easy to clean—a wipe and it's bright.

**NON-CONDUCTOR.** Kys-ite's dielectric properties make it invaluable where safety is a factor. Very poor conductor of heat and cold (rates 1,000 times below aluminum in heat transmission). Non-resonant and non-reverberating.

**ADAPTABILITY.** Large hollow forms, intricate pieces with projections and depressions, large and small shapes with thin wall sections—all can be molded of Kys-ite without setting up weakening stresses and strains. Easy to work—can be machined and drilled to close tolerances.

KEYES FIBRE COMPANY, 420 Lexington Avenue, New York 17, N. Y. • Plant at Waterville, Maine

# MAKE THIS TEST

## AND SEE WHY **90%** OF ALL



## RECESSED HEAD SCREWS

## HAVE THE SAME RECESS

## IT'S PHILLIPS



There's nothing like making the *driving test* to convince yourself that there's nothing to match the all-around superiority of the recess design in Phillips Screws! It quickly demonstrates that Phillips is truly a scientifically *engineered* recess in which every angle, every dimension has a definite purpose, contributing to driving ease and speed — and to fastening strength.

Once you make this "driving test" you'll see how Phillips Recess Head Screws fully utilize turning power . . . why your workers can "get going" without fumbling, wobbling, skidding starts . . . can sustain speed and make *consistently tight* fastenings without getting all tuckered out.

That's because the driver point *automatically centers* itself in the Phillips Recess, so that screw and driver "handle" like one unit!

You'll also discover that you can set screws up tight without danger of wrecking the Phillips Recess. Those *rounded* corners of the Phillips design will not crush under pressure. And that rugged screw head won't pop off, either, because the Phillips Recess does not weaken it!

The driving test also explains why the Phillips Recess is found in 90 per cent of all assemblies where recessed head screws are used . . . and why Phillips is the only recess ever ok'd by 23 leading screw makers!

**To Make Wartime Quotas and Peacetime Profits . . .** get the faster starting — faster driving — stronger, better looking fastenings that only screws with Phillips Recessed Head can give you!



# PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS



### IDENTIFY IT!

Center corners of Phillips Recess are rounded . . .

NOT square.

Bottom of Phillips Recess is nearly flat . . .

NOT tapered to a sharp point.

**23 SOURCES**

American Screw Co., Providence, R. I.  
Atlantic Screw Works, Hartford, Conn.  
The Bristol Co., Waterbury, Conn.  
Central Screw Co., Chicago, Ill.  
Chandler Products Corp., Cleveland, Ohio  
Continental Screw Co., New Bedford, Mass.  
The Corbin Screw Corp., New Britain, Conn.  
General Screw Mfg. Co., Chicago, Ill.

The H. M. Harper Co., Chicago, Ill.  
International Screw Co., Detroit, Mich.  
The Lamson & Soniers Co., Cleveland, Ohio  
Manufacturers Screw Products, Chicago, Ill.  
Millers Rivet and Machine Co., Milford, Conn.  
The National Screw & Mfg. Co., Cleveland, Ohio  
New England Screw Co., Keene, N. H.  
Parker-Kelce Corp., New York, N. Y.

Pewaukee Screw Co., Pewaukee, R. I.  
Phenit Manufacturing Co., Chicago, Ill.  
Rending Screw Co., Harrisburg, Pa.  
Russell Burdall & Ward Bolt & Nut Co., Port Chester, N. Y.  
Russell Manufacturing Co., Waterville, Conn.  
Shepherd Bros., Chicago, Ill.  
The Southington Hardware Mfg. Co., Southington, Conn.

# *Plastic* COUPLINGS



ABOVE: Plastic coupling parts coming from one of many injection molding machines in the Amos plant. BELOW: Parts being inspected and trimmed, ready for assembly.



*Molded  
by the  
Millions*



● If all the plastic couplings molded by Amos were used to join 50-foot lengths of hose into a single line, we could turn on the hydrant here and sprinkle water on the desert land of central Australia—and still have some extra hose sections for side excursions . . . Plastic hose-couplings are units of three separate pieces—all molded by the extra fast and efficient injection process. This is but another example of what Amos does for many different companies who appreciate the quality, economy and colorful sales appeal of molded plastics.

\* \* \*

Many a product engineer is planning now to redesign parts and products for plastics—to meet the flood of business after the war. For such men, Amos has prepared an informative booklet of general information and technical data. You need only to write for your copy of "Will You Use Plastics?" It's free. No obligation. Just address . . .

**Amos**  
MOLDED PLASTICS...

Custom Molders of Parts and Products  
by the Injection Process

AMOS MOLDED PLASTICS, EDINBURGH, INDIANA • Division of Amos-Thompson Corporation

## HOW TO USE COOLANTS WITH PLAX



PLAX POLYSTYRENE IS SUPPLIED in sheets, rods and tubes. It is also available in the famous Polyflex® Sheet and Polyflex® Fiber, tough and flexible extruded forms with wide insulation application. Machined parts such as those shown above (in actual sizes) are produced by Plax, to your specifications. Plax also supplies a polystyrene cement.

Other Plax wartime production includes various forms of cellulose acetate, cellulose acetate butyrate, ethyl cellulose, methacrylate, and styramic.

Write for bulletin on "Fabricating Polystyrene," containing full details of polystyrene's properties.

\*Trade Mark Reg. U. S. Pat. Off.

## POLYSTYRENE

If the temperature of polystyrene is not raised above 60°C (140°F) during machining operations, no difficulties will be encountered.

Gumming, surface disfigurations, and crazing (surface cracking) occur when heat generated by drilling or cutting exceeds this temperature. Crazing will occur even before gumming, and it may appear immediately, or a week after machining.

It is almost impossible to measure the surface temperature rise of plastics, because heat is generated for a very short time at a usually very small point of cutting. Polystyrene's splendid electrical insulation properties are accompanied by exceptional heat insulation qualities, which prevent this plastic from quickly giving up its heat.

Overheating can be prevented by (1.) elimination of excessive friction and provision of adequate chip clearance, and (2.) use of a proper coolant. Kerosene or other ordinary cutting oils will damage polystyrene.

Laboratory study at Plax has shown that a water soluble coolant that will wet both polystyrene and metal gives the best cooling action. (And, incidentally, eliminates change-overs when the same machine is used for both plastics and metals.)

Most coolants in this category are injurious to polystyrene but several that are completely neutral to the plastic are available at low cost. Two of these are Shell Oil Company's Vergo Oil 38-P and Stanco's Solvac 100-M Special. One of these, or a coolant equal in performance, should always be used in all sawing and drilling and in some turning and milling operations.

When the above-mentioned points about machining polystyrene are recognized and provided for, intricate parts can be produced without trouble due to overheating.



**TALK TO TAYLOR NOW**

**ABOUT THE PART**

**LAMINATED PLASTICS**

**WILL PLAY IN YOUR**

**POST-WAR PRODUCTS**

To help you *now* with your post-war plans, we have created and manned a Post-War Development Department. This Department has *no duties* other than those of discussing with forward-looking manufacturers the contributions that Vulcanized Fibre, Phenol Fibre, or Phenolastic Fibre\* can make to the performance and economy of the products of tomorrow.

Before you decide that a product or a part can best be made from aluminum or glass, steel or wood, or any other material, it will pay you to find out whether or not that product or part can be made better, cheaper, or faster in laminated plastics. Consultation on such problems with the engineers

in our Post-War Development Department is yours for the asking, without cost or obligation. Write us, in complete confidence, about your plans and problems.

\*A new development by which finished sheets of Phenol Fibre can be reheated in your own plant and formed permanently to almost any shape in inexpensive, wooden dies.

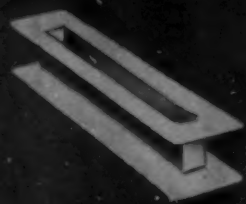


*Mass-produced by machining from tubes of Phenol Fibre, this radio part combines light weight, high dielectric quality, low moisture-absorption, and the ability to stand severe shock. Whatever combination of qualities you require, it's a rare case indeed that can't be solved by Laminated Plastics.*

**POST-WAR DEVELOPMENT DEPARTMENT OF**

**TAYLOR FIBRE COMPANY**

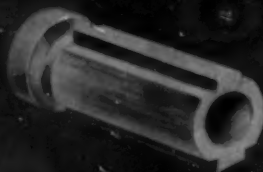
**LAMINATED PLASTICS: VULCANIZED FIBRE • PHENOL FIBRE • Sheets, Rods, Tubes, and Fabricated Parts**  
**NORRISTOWN, PENNSYLVANIA • OFFICES IN PRINCIPAL CITIES • PACIFIC COAST HEADQUARTERS: 844 S. SAN PEDRO ST., LOS ANGELES**



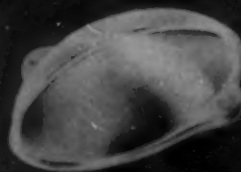
INTERLOCK



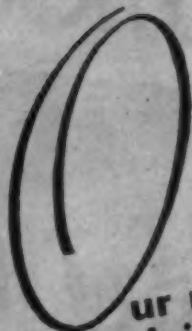
COMPRESSION



WAFER



ARNOLD



Our reputation was earned by doing difficult close tolerance plastic molding and fabricating.

Please don't insist on us doing the ordinary type of "loose" tolerance, long run work, as our entire facilities are devoted to the production of precision parts.

Your unique plastics problems will receive prompt attention.

**Brilhart**  
LTD.

435 MIDDLENECK ROAD  
GREAT NECK, N.Y.  
Phone: GREAT NECK 4054

## SIX PLASTICS—WITH SEVERAL HUNDRED VARIATIONS

The broad and versatile Family of Monsanto Plastics is one of the largest and most varied groups of plastics offered by any one manufacturer. There are six basic types:

**1. LUSTRON**—Polystyrene molding compounds which are produced from one of the newest and most promising of the synthetic resins . . . and are notable as the lightest of all commercial plastics with excellent dimensional stability, unsurpassed electrical qualities and outstanding appearance values.

**2. RESINOX**—Phenol-formaldehyde resins which are compounded with various fillers into strong, heat-resistant molding compounds with good electrical qualities . . . and are also supplied in liquid or powder form for bonding other materials into sheets or simple shapes of exceptional strength and large area.

**3. VINYL ACETALS**—These rubber-like resins are processed into molding compounds . . . supplied in transparent, translucent or opaque sheets or rolls . . . compounded into special "dopes" or sheets for "rubberizing" fabric . . . or special bonding resins.

**4. FIBESTOS**—Cellulose acetate, also tough, strong and colorful which is compounded with various plasticizers into molding compounds to be shaped by heat and pressure into final form . . . and is also supplied as sheets, rods, tubes, and continuous rolls.

**5. RESIMENE**—These new melamine resins, like Resinox, will be supplied in powder or liquid form for bonding other materials . . . and compounded with fillers into molding compounds with promise of good heat resistance, excellent resistance to water and chemicals, an unlimited color range and superlative electrical qualities.

**6. NITRON**—Tough, strong, water resistant and dimensionally stable cellulose nitrate which is supplied in a limitless range of colors in sheets, rods, and tubes largely for mechanical fabrication into finished form.

For more complete information on all these materials, write on your business letterhead for the 24-page book prepared especially for product designers.



## How to Find the Best Plastic for Your Product

No one plastic can honestly be offered as a solution to all problems. In the family of Monsanto Plastics, for example, there are six broad, basic types and several hundred standard compounds, each with different properties, each designed for different uses.

When you have a set of blueprints to translate into finished products, finding the one *best* material from that wide array can be a headache—or a sure and simple process.



The secret is to put *two* experts to work on the problem—and to get them together as early in the development of your product as you can. First and most important of the two is you.



Obviously you and your engineers are the only ones who can answer such all-important questions as:

What service conditions will the product meet?

★ ★ ★

The broad and versatile family of Monsanto Plastics includes: Lustron polystyrenes • Monsanto vinyl acetals • Nitron cellulose nitrates • Fibestos cellulose acetates • Resinox phenolic compounds • Resimene melamine compounds. Forms in which they are supplied include: Sheets • Rods • Tubes • Molding Compounds • Castings • Industrial Resins • Coating Compounds • Vespak Rigid, Transparent Packaging Materials.

What functions will it be expected to perform?

How many will you need—and how fast?

How much should it cost to produce?

The other partner to your search: a Monsanto Plastics consultant.

Because the family of Monsanto Plastics is one of the broadest, most versatile groups of plastics offered by any one producer, your Monsanto consultant can make two important contributions.



From his wide experience with many different plastics he can give you both expert and unbiased advice on the material best suited to your needs.

From his wide knowledge of the plastics industry, he can suggest the names of molders or fabricators best equipped for work on your particular problem.

To get in touch with a Monsanto Plastics consultant, write: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Mass.





WHEN YOU'RE IN A *Tight Spot* . . . TRY NIXON



Recover your composure . . . When you are confronted with tie-ups, NIXON generally rises to the situation and 'delivers'.

*MATERIALS: Cellulose Acetate • Cellulose Nitrate • Ethyl Cellulose*

*AVAILABILITY: Sheets • Rods • Tubes • Extruded Profiles  
Cellulose Acetate and Ethyl Cellulose Molding Powder*

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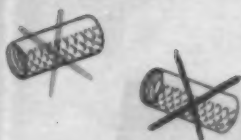
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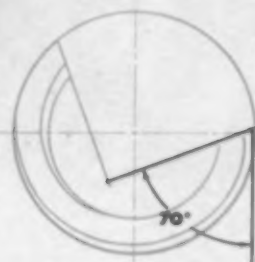


# WHY INSERTS?

● **SAVE VITAL MAN-HOURS**

● **SPEED-UP PRODUCTION**

● **ELIMINATE SCREW MACHINE PARTS**



End view showing sharp cutting edge. Also available with standard machine screw thread—specify type 23.

## with **SHAKEPROOF** TYPE 25

### THREAD-CUTTING SCREWS



#### COMPLETE ENGINEERING SERVICE

Shakeproof engineers have studied thoroughly the fastening of plastic parts and are conducting continuous research in the development of improved fastenings and assembly techniques. They are ready to discuss with manufacturers any plastic fastening application. They offer their experience and counsel in a sincere spirit of helpful service and without any obligation.

In all types of plastics this specially developed screw actually cuts its own thread as you drive it. No inserts—no separate tapping! Speeds assembly—reduces costs! And, because each screw remains in the thread it has cut for itself, a strong, tight fastening is always certain. Try it yourself—write for free sample Test Kit No. 10 today!

**SHAKEPROOF inc.**  
"fastening Headquarters"



Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS  
2501 North Keeler Avenue, Chicago 39, Illinois

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The quality of any stearate depends upon the quality of the metallic oxide and the stearic acid used in its composition—but the stearic acid is the primary factor. One reason behind the success of Witco Calcium and Zinc Stearates, as plastics lubricants, is that only Witco Stearic Acids are used in their production. The advantage of using these high quality stearic acids can be seen in the exceptional purity, and the even, fluffy texture of the resulting products. Try Witco Stearates. You will secure better and more economical results. Write for samples and further details.



**WITCO CHEMICAL COMPANY** MANUFACTURERS AND EXPORTERS  
[FORMERLY WISHNICK-TUMPEER, INC.]

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# Cruver

*A Great Name in Plastics*



**SPECIALISTS IN CONVERTING PLASTICS TO WAR  
LEADERS IN POST-WAR PLANNING, TOO**

**FOR WAR:** Cruver molds a shock-proof, acetate handle around a metal Machete blade. Solid construction enables soldiers to use handle as bludgeon — will not splinter. Entire assembly is done by Cruver, also.

**POST WAR:** light-weight housing for Acousticon molded in special bas-relief, designed in transparent methyl methacrylate. This hearing aid gives an idea of the type of work which Cruver offers to all industries in meeting their post-war requirements. Finish is applied on inside, seen through the plastic. Four inserts in each of two halves.

# Cruver

**MANUFACTURING COMPANY**

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## Your Plastics Molder can help you Catch Business by **DESIGN!**

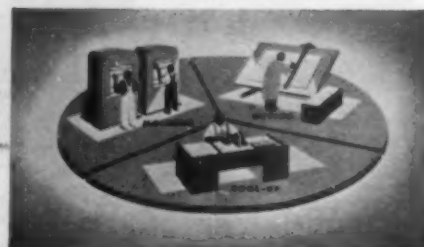
There's plenty of sales appeal in up-to-date, streamlined styling of plastic parts.

But unless Design sleeps right in the same bed with Engineering, there are plenty of headaches. Both these functions have to be on the job at once to combine styling with proper handling of wall sections, inserts, undercuts, bosses, fillets and plenty of et ceteras.

But that's only the start of the story, here at Kurz-Kasch. In growing up with the plastics industry, we've found that experts on Mold-making, Molding and Finishing ought to be consulted, too, while products are still plans.

So we bring them all together here

at the Plastics Round Table. Your engineers are invited to discuss your plastics problems here, with men representing a generation of molding experience. Behind them are the resources of one of the largest and best-equipped exclusive molding plants in the country.



PLANNING *always* brings home the bacon! If your post-war plans include plastics, let us urge that you consult your molder early. His assistance now on design and material specifications can be doubly valuable.

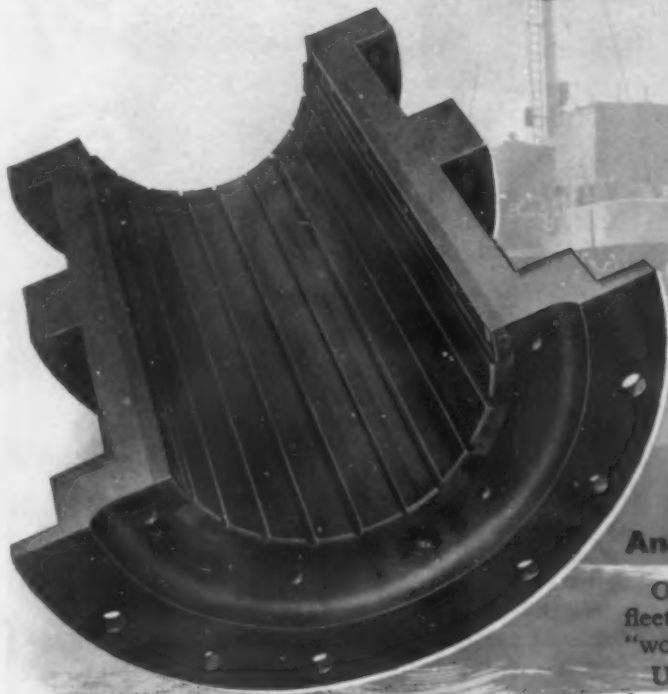
# KURZ-KASCH

*For over 25 years Planners and Molders in Plastics*

Kurz-Kasch, Inc., 1421 South Broadway, Dayton 1, Ohio

Branch Sales Offices: New York • Chicago • Detroit • Indianapolis • Los Angeles • Dallas  
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# micarta stern tube bearings for "CONVOY- CHAPERONES"



## BOMB RACKS

have been successfully molded of Micarta... furnish an excellent example of Micarta's strength and the skill of Westinghouse engineers in intricate molding assignments.

## PUMP RINGS

made of Micarta do not soften in service, wear slowly, will not score cylinder walls, and are inert to mildly corrosive liquids or gases.

## PULLEYS

of Micarta extend life of both pulley and cable. Millions used in aircraft; new applications now being discovered on ships.



## Another example of versatile Micarta at work

Out in the Atlantic, our stout old ladies of the merchant fleet haven't been safe. Bad neighbors were hunting in "wolf packs".

Uncle Sam put a stop to that with capable "chaperones"—fast, deadly Destroyer Escorts. Halfway in size between destroyer and corvette, they can outrace any surfaced submarine and blast to the bottom any undersea threat to the convoy.

The stern tube bearings on many of these tireless craft are Westinghouse Micarta—the tough versatile plastic. Here's why:

**MICARTA WEARS LONGER**—in many ships has multiplied bearing life 400 per cent. It wears evenly, smoothly, and eliminates scoring.

**MICARTA RESISTS SHOCK**—its compressive and tensile strength is much lighter than wood. It will not split or crack.

**MICARTA IS UNHARMED BY SALT WATER**—and reduces galvanic action. Water is its best lubricant.

Micarta marine bearings, as well as countless other applications of Micarta, are produced by Westinghouse—largest laminators of industrial plastics. If these examples of Micarta at work suggest answers to present or postwar problems you have still to solve, consult Westinghouse Micarta engineers. A copy of the new Micarta Data Book is yours for the asking. Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa., Dept. 7-N.

J-06343-A

# Micarta

THE INDUSTRIAL PLASTIC



PLANTS IN 25 CITIES...

OFFICES EVERYWHERE



### High Precision Molding ?

Powdered Metals, Abrasives or Plastics? If so, prevent off-gauges with this Birdsboro stress-compensating Hydraulic Press. New frame and cylinder construction minimizes deflections so parts may be pressed accurately to thickness. Self-contained with quick pressure adjustment, preset by handwheel. Can be arranged either for cold pressing or for hot work with steam platen — either single or multiple openings, single or two sided feed. Available in sizes from 250 to 3,000 tons. Larger sizes can be readily developed. Write Birdsboro today.

*For additional information send for the Birdsboro Hydraulic Plastic Press Catalog.*



BIRDSBORO STEEL FOUNDRY AND MACHINE COMPANY

# BIRDSBORO

## HYDRAULIC PLASTIC PRESSES



# The Refrigerator that talks back

If you read the magazine writers' post-war ideas you'll get the impression we won't have to lift an arm in the post-war world from putting our clothes on in the morning to going to bed at night.

Refrigerators, it is supposed, will be made in strange shapes and even with mechanisms that will tell you what food is in the icebox. Frankly, we don't believe it.

We do believe—based on experience—that extruded plastics will have an important part to play in the iceboxes and refrigerators that will be built in this country.

We pioneered the first application of extruded plastics to the refrigerator industry. Our war-time experience has given us mastery of new materials and has broadened the scope of the extrusion process.

We are confident that we will have much to offer refrigerator manufacturers in both flexible and rigid profiles. We are working with designers now.

We also do injection molding.

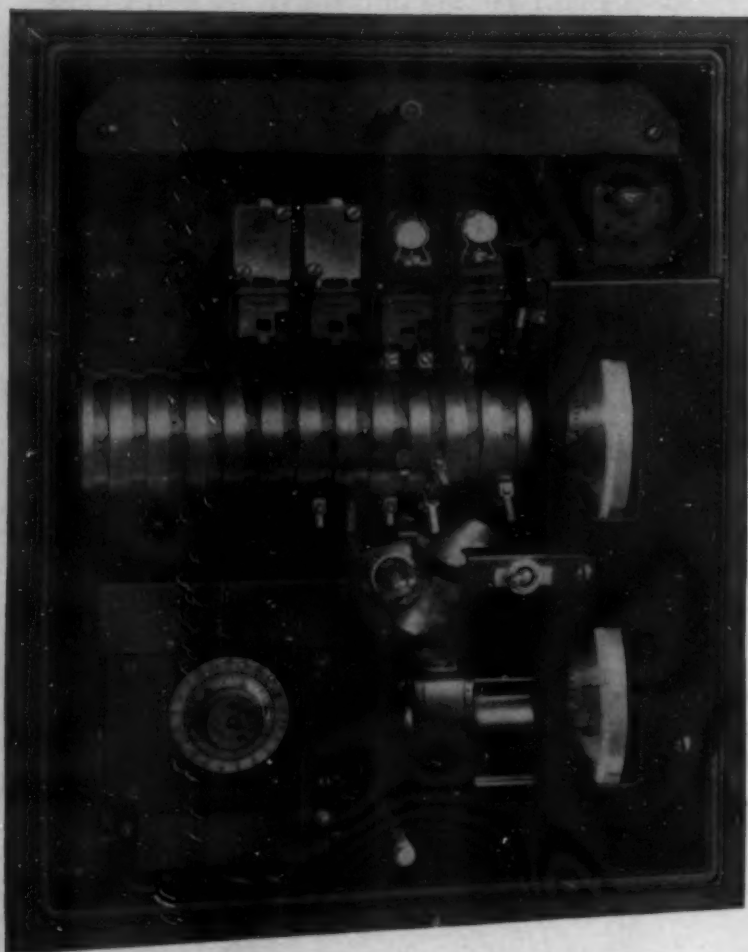


**DETROIT**  
**MACGOLD**  
**CORPORATION**  
12340 Cloverdale Ave.  
Detroit, Michigan

# "Something **NEW** has been added"

(APOLOGIES TO OLD GOLD)

## to the TAYLOR FLEX-O-TIMER!



*Instruments for indicating, recording, and controlling temperature, pressure, flow, humidity, and liquid level.*

**T**AKE a good look at this new version of the Taylor Flex-O-Timer. It's really *two* instruments in one! To give you even *better* automatic platen press operation, our engineers have installed a small auxiliary timing mechanism in the lower left corner of the Flex-O-Timer case. "Wheels within wheels," you might say.

The Flex-O-Timer initiates and terminates all necessary process functions, while the auxiliary timer governs the *molding period only*. So when the molding period has to be increased or shortened, you can do it with one simple dial adjustment, without disturbing any of the settings on the Flex-O-Timer itself.

Not only will the Flex-O-Timer save you valuable time and manpower, but with its infallible accuracy you can be sure you'll get *identical* press loads every time. All you do is load the press and push the button. Your Taylor Field Engineer is anxious to show you how it can help you improve quality and cut costs. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

**BACK THE ATTACK!**  
**BUY AN EXTRA WAR BOND**  
**TODAY!**



*Taylor Instruments*  
**— MEAN —**  
**ACCURACY FIRST**

**IN HOME AND INDUSTRY**



# PRODUCTION

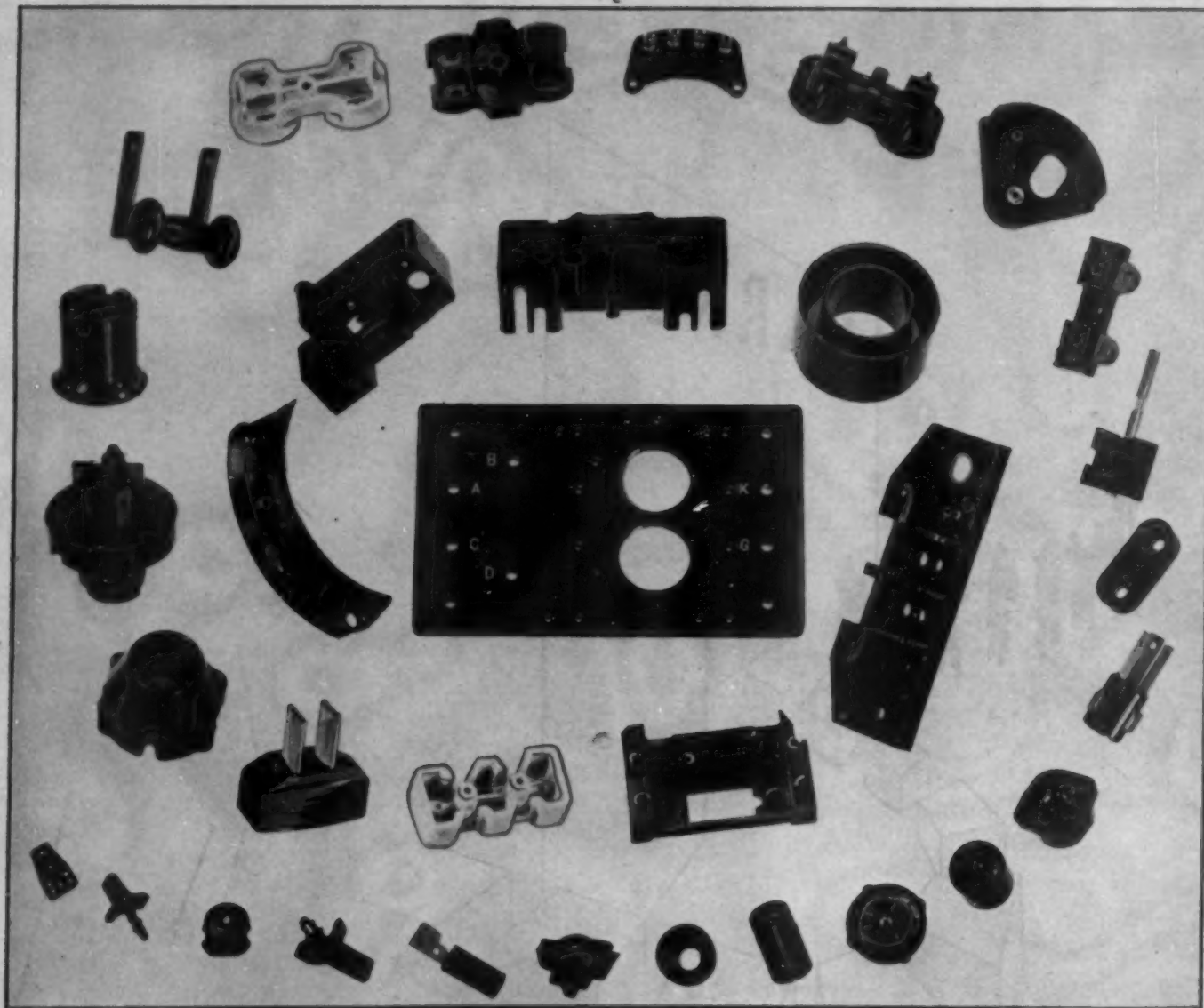
Another phase of UNIVERSAL service is a production department equipped to produce custom moldings in quantities to meet our customers' own production schedules. Ample plant facilities include a wide range of equipment . . . molding by compression or injection methods, die making, machining, finishing, etc. . . . plus skilled workmanship and experienced engineering supervision. Manufacturers are invited to consult our Planning Division in connection with any postwar plans they may have involving the use of plastic moldings.

## UNIVERSAL PLASTICS CORPORATION

NEW BRUNSWICK • NEW JERSEY

New York Office: New York 17: 12 East 41st Street  
Chicago 3: Steel Mill Products Co., Inc., 176 West Adams Street

Philadelphia 6: Paragon Sales Co., Inc., 402 Cherry Street  
Detroit 2: June & Company, 719 New Center Building



## BETTER ELECTRICAL PARTS THROUGH ELECTRONICS

Watertown has molded millions of Neillite\* parts for the electrical industry ever since the high dielectric strength of plastics first established their use in that field. Advances in electrical manufacturing have called for increasingly intricate shapes, requiring exact tolerances, and frequently embodying metal inserts.

To meet the demand for heavily increased production of new and more difficult shapes, Watertown has adopted high frequency heating with Megatherm†. This method of electronic heating homogenizes the molding material throughout, producing a completely uniform structure and eliminating internal stresses. Lower pressures can be used, thus reducing breakage of delicate insert pins and greatly reducing distortion.

Electronic preheating also facilitates free flow of material in the mold, which eliminates porosity and makes for greater density in the finished shape.

Manufacturers of radio, electrical and electronic instruments will welcome this newest technique utilized by The Watertown Manufacturing Company, 1000 Echo Lake Road, Watertown, Conn. Branch offices in New York, Chicago, Cleveland and Detroit.

\*General purpose Neillite 300.

†Made by Federal Telephone & Radio Corp.

# *Watertown*

A NAME AS OLD AS THE PLASTICS INDUSTRY

# *The Machine of Tomorrow—* **TODAY!**



## *Sav-Way* **SPITFIRE**

**ELECTRO-HYDRAULIC INTERNAL GRINDER**

**Modern Functional Design  
Throughout**

★ **Neoprene Insulated**

★ **Famous Gold Seal  
Spindle**

★ **Electrically-Operated  
Diamond Wheel Dresser**

Ready ahead of time—the Sav-Way MH-1 combination hand and electro-hydraulic internal grinder. 5/32" minimum table stroke! Gatling gun table speed, through the use of aircraft-type micro-limit switches and solenoid-operated valves. Electrical, automatic, adjustable cross feed. Dozens of outstanding features! As up-to-the minute as the plastics industry, itself! It's a postwar machine—ready now to help speed today's war production! Its low cost will surprise you.

## *Sav-Way*

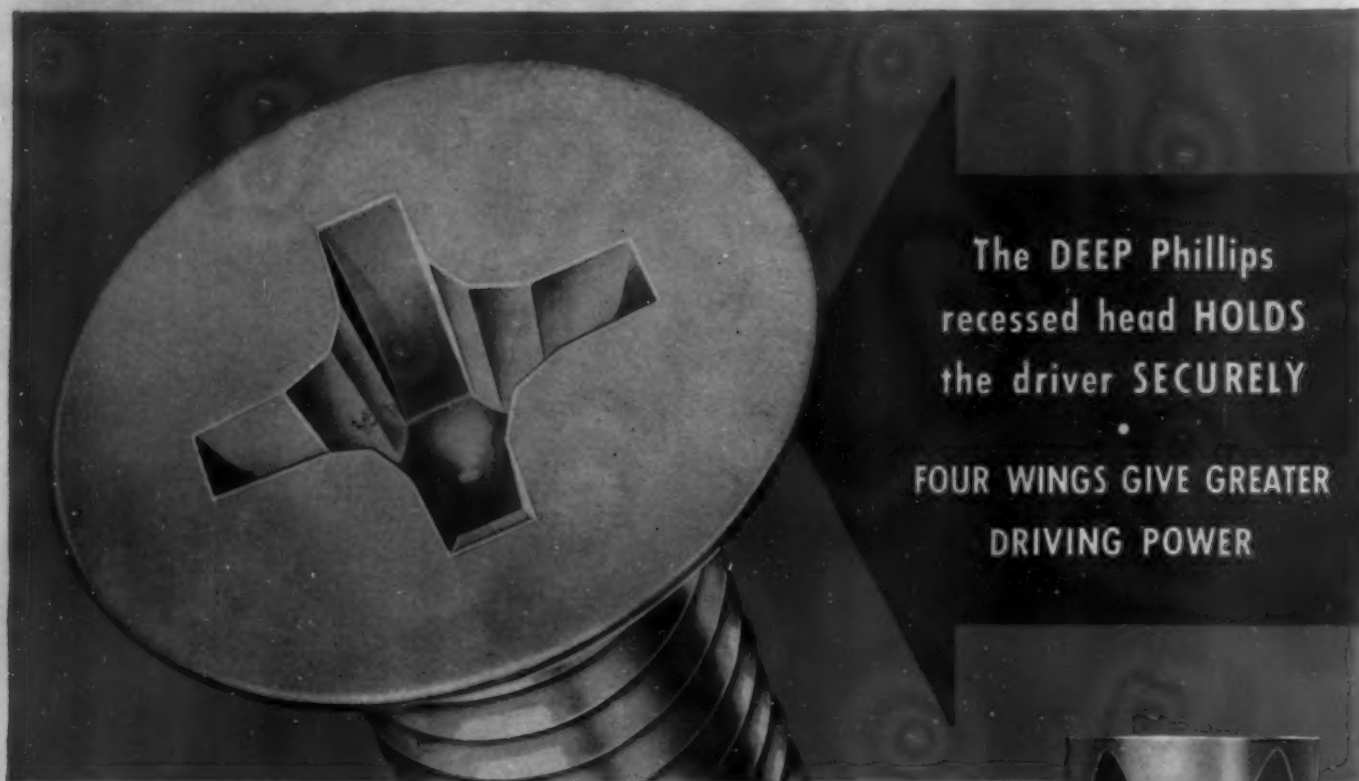
**INDUSTRIES**  
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*Send for Actual Photographs,  
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BUILDERS OF HAND AND HYDRAULIC INTERNAL GRINDERS • PRODUCERS OF GOLD SEAL SPINDLES  
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Here it is...the Famous Phillips Recessed Head Screw...America's *most improved* screw head. It drives faster, easier...gives better fastenings. **MADE BY NATIONAL SCREW...**

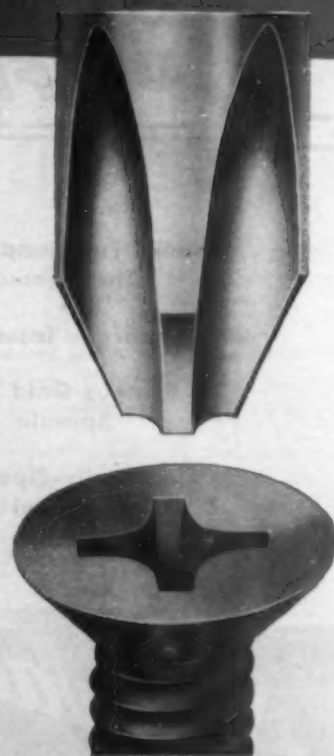


## 7 distinct advantages of the Phillips Recessed Head



1. Self-centering on the driver
2. Holds driver from slipping
3. Four "wings" give greater driving power
4. Eliminates head breakage
5. Frees operator's hand to hold work
6. Makes better appearance—prevents marring work
7. Simplifies hard-to-get-at jobs.

**National**  
HEADS AND THREADS  
PRODUCTS



**THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.**

# MODERN PLASTICS

JUNE 1944

VOLUME 21

NUMBER 10



"Information,  
Please"



**H**OW to give the consumer the information he wants about the goods he buys has always been a vexing problem. It is a problem that crops up chiefly in eras of plenty when new materials and new products are being introduced to the consumer and he has a wide choice of merchandise. In scarcity eras he is glad to take what poor merchandise he can get and nurse along his grudge against the manufacturer until there is a buyer's market once more. Even in good times the manufacturer who ushers in a new material or a new product without explaining its use may create an irate consumer. Not to take issue with that great apologist of the modern world, Sigmund Freud, it is our belief that as many cases of frustration result from wishful dreaming about meeting the manufacturer of "that bum razor" as about wishful dreaming of one's mother. If consumer and manufacturer could only meet face to face! But since these happy reconciliations occur only in rare meetings around the tables of consumer buying organizations, how is the manufacturer at large to give the average consumer the information he wants so that the consumer will not misunderstand or misuse the product?

The answer usually has been informative labeling and informative advertising. As each new material has appeared it has been accompanied by a blast of advertising information about how to use and how not to use it. We can all remember how we were warned by an attached informative label not to use lye on the new aluminum saucepans and not to use a hot iron on rayon. In its early days rayon was frequently confused with silk to the annoyance of the silk importers who, believing that it could not be competitive, pressed for legislation requiring that materials be identified. Thus forced into a campaign to identify their material, the manufacturers of rayon wisely identified also its attributes and its limitations, with the result that today rayon stands on its own merits and occupies an unassailable position in textiles.

Curiously enough, the raw material or resin producers, molders or fabricators, and the end users selling plastics at retail have never organized a concerted campaign to identify

their materials, although plastics were at once revolutionary and competing in many fields, but were content to let them creep into the market, usually in the traditional guise of their metal or wood predecessors. Designs and shapes which were necessary in wood or metal but which had no relation to a molded product were continued in plastic manufactures. If the plastic articles bore labels at all, these seldom informed about the properties of the new materials but only touched on weaknesses of the old, stating, for instance, that "this article will not rust or tarnish," but not stating the more important fact that it might warp in boiling water.

An "informative label," when stripped to its bare essentials, is just a label stating what the material is and how to take care of it. It has advanced to its present haughty title, "the informative label," through having to battle its way against "grade labeling" and "brand labeling" through the bastions and ramifications of consumer committees which have advanced the humble label to a subject for Ph.D. research—abstruse, profound, erudite. Looking back through the mists into our childhood when a label was just a label and an apple was edible, we think nostalgically of but few informative labels. The label of that date had less need to be informative because there were fewer new products. The increase in consumer goods in the late twenties and thirties brought the informative label, which may give highly technical information, but its bare essentials are a statement of what the material is and what its limitations are.

## Fifty centuries of labels

The problem of consumer information is by no means new, and labeling, they say, was introduced first by the Assyrians 5000 years ago, with the use of clay drums marked with hieroglyphics. It is nice to think that the drums also bore washing instructions saying, "Wash only in the siltless water of the River Euphrates. Do not flail indefinitely while gossiping with your girl friends. This fabric, though woven of the finest Nile Valley long staple cotton, will stand only 21 flailings each wash."

*(Please turn to next page)*

**Morning Glow TOWEL**

Gay plaids with the special construction feature of colored loopel

Most plaid towels sold elsewhere have color only in the underweave.

**NO. 5133**

**SIZE 28 x 44 in.**

SEE REVERSE SIDE

**QUALITY SPECIFICATIONS**

Weight 8 oz. per sq. yd. and absorbs 30 oz. moisture per sq. yd. There are 340 loops and 98 yarns per sq. in. (warp 68, filling 30). Warp yarns resist 45 lbs. strain—filling yarns 40 lbs. per in.

All figures are average

This is the type of label suggested by the National Consumer-Retailer Council, Inc.

**SOLD ONLY BY**

**SEARS, ROEBUCK AND CO.**

21412-23

**PACIFIC PERCALE SHEETS**

Inside this Percale are the facts you want to know about sheets.

**SIZE CHARTS**

**SHEET WIDTHS**

48" Crib	63" Single Bed
52" Crib	72" Twin Bed
54" Crib or Youth's Bed	81" 3/4 or Double Bed
56" Full Double Bed	

**SHEET LENGTHS**

Recommended	After Bleaching	After Bleaching	Not After Bleaching
60"	60"	60"	60"
66"	66"	66"	66"
72"	72"	72"	72"
78"	78"	78"	78"

**PILLOW CASE SIZES**

Width (Standard)	Length	For Pillow
20" x 26"	54"	20" x 26" or 20" x 28"
24" x 30"	58"	24" x 30" or 24" x 32"

**PACIFIC PERCALE SHEETS AND PILLOW CASES ARE *Balanced!***

Pacific Percale Sheets and Pillow Cases (182 finely combed threads per square inch) are balanced to give you luxurious softness and lightness with low iron cost and savings. Their beautiful finish and smooth, even texture give you greatest possible sleeping comfort.

Pacific Mills gives you here all the facts vital to the service you will receive from these sheets and pillow cases. But more important to you than any one of these questions alone, is the skill with which they are brought together in perfect balance.

This means that no one quality is achieved at the expense of any other. Balance gives you the greatest value for your money.

Made under complete control from the raw cotton to the finished product by the manufacturers of Pacific Percale.

**PACIFIC MILLS** 214 Church Street, New York

**CERTIFIED**

as tested according to methods prescribed in U. S. Government Central Specifications CCC T-191a.

**WHAT THEY ARE MADE OF:** All American selected premium cotton.

**HOW THEY ARE MADE:** Plain weaves. Tens, not cut, to insure straight hems after laundering.

**Dimensions:** See face of label and the size charts (back of this page).

**Thread counts:** Pacific Percale Sheets and Pillow Cases average 182 threads per square inch—54 lengthwise, 98 crosswise.

**Weight:** Pacific Percale Sheets and Pillow Cases average 3.7 ounces per square yard.

**Finishing materials:** Other than cotton: Less than 2.5%. No finishing to make them even better to the touch than they really are.

**WHAT THEY WILL DO:** Standing strength (test of "breaking load" on each direction) for Pacific Percale Sheets and Pillow Cases equals 128 pounds per square inch—56 lengthwise, 62 crosswise.

**Shrinkage:** Pacific Percale Sheets and Pillow Cases shrink approximately 6% in length, in width nil. See details in size charts (back of this page).

1, 2—Sears, Roebuck towel labels and Pacific Mills fact-tags are considered models of well-written informative labels. Both of them carry some advertising matter

In the Middle Ages, the problem of giving the consumer information about the quality and standards of his goods was bogged down like everything else by the thundertides of emotion and religion. Crusades, cathedrals and courts of love occupied the world's attention. Throughout the western world it was a scarcity era for consumer goods—a seller's market when labels and standards were unnecessary. Even in heavy industry standards and labels were unnecessary because materials were few and their users knew them well. In building a cathedral like Mont St. Michel or Chartres, the finest quality silica was assured for the windows which are still the wonder of the modern world by reason of the fact that each glass craftsman knew silica well and understood how to use it to the best advantage. There was, of course, the further stimulus of more direct methods of punishment than exist in our modern world: those who supplied poor silica for the cathedral not only faced the certainty of sizzling in hellfire but also the summary penal methods of the lord of the manor who was having himself and his lady enshrined in worshipful poses in the stained glass.

With the breakdown of the feudal barons' power and the rise of the towns, came the Renaissance and an increase in wealth and materials. As the retailing trade grew up, the consumer grew more demanding and was, for the first time,

in a position to complain about materials and qualities. Bit by bit regulations began to appear to protect the consumer from graft or to answer the questions he wanted to know about his goods but, as often happens in our day, they were not always honestly or efficiently administered. Further, no form of consumer standards continued to represent changing consumer wants because the standards remained fixed while the consumers' wants were changing in the rapidly expanding market.

New materials constituted the basis of the change from the medieval to the modern world, and with the coming of each new material arose the problem of teaching the consumer how to use it. The tribe which first used metal no doubt kept its use and care a tribal secret. The Cleaning of the Hunting Knife to prevent rusting was probably a happy tribal ritual followed by The Drinking of the Grape, The Drinking of the Grape being immediately followed by The Telling of the Secret, when some tribal Romeo boasted to a woman in another tribe about the big secret political work he was engaged in of an evening—The Cleaning of the Knife. Thus perhaps leaked out the secret of metal. But with the era of competitive manufacture the situation was reversed: the manufacturer was anxious not to keep the material secret but to exploit it, and to explain to the consumer the best use and care of his article.

Advertising, standards and labels crept in with the 20th Century. The household economy of the 19th Century, particularly in America, had been relatively simple. Grand-

**DO NOT SAND  
OR BUFF**



**WASH AND  
WAX ONLY**

**PLEXIGLAS ROHM & HAAS**

**THIS IS  
PLEXIGLAS**

**WEATHER-PROOF PLASTIC**

TO AVOID SCRATCHING, DO NOT Wipe WITH DRY CLOTH, BUT WASH WITH GRIT-FREE SOFT CLOTH, CHAMOIS, OR SPONGE, USING PLenty OF WATER, SOAP, KEROSENE, OR NAPHTHA MAY BE USED TO REMOVE GREASE AND OIL, BUT ACETONE, BENZENE, AND LACQUER THINNERS WILL AFFECT THE SURFACE. AUTOMOBILE OR FURNITURE WAXES MAY BE APPLIED.

**ROHM & HAAS CO.  
PHILADELPHIA, PA.**

■ This Plastic Material is much stronger and clearer than fine glass. It is weather-proof. With ordinary care, it will sparkle like crystal for a lifetime. ■ Use soap and water and grit-free soft cloth, chamois or sponge to clean it. Avoid the use of kitchen scouring powders and similar abrasives. Automobile or furniture waxes may be used to remove scratches. ■ This package was packed and inspected by—

■ If the contents are not entirely satisfactory, we will consider it a favor if you will notify us and return this slip.

**WE WANT YOU TO KNOW!**

■ Our plastic gifts are not made from critical war materials. Los Angeles aircraft plants supply us with pieces of plastic materials too small for their — or any other — War work.

**CHRYSON'S HOLLYWOOD, CALIFORNIA**



3—A label for acrylic plastics stresses the care to be given the products. 4—Purchasers of fabrics carrying this tag know they meet National Bureau of Standards tests

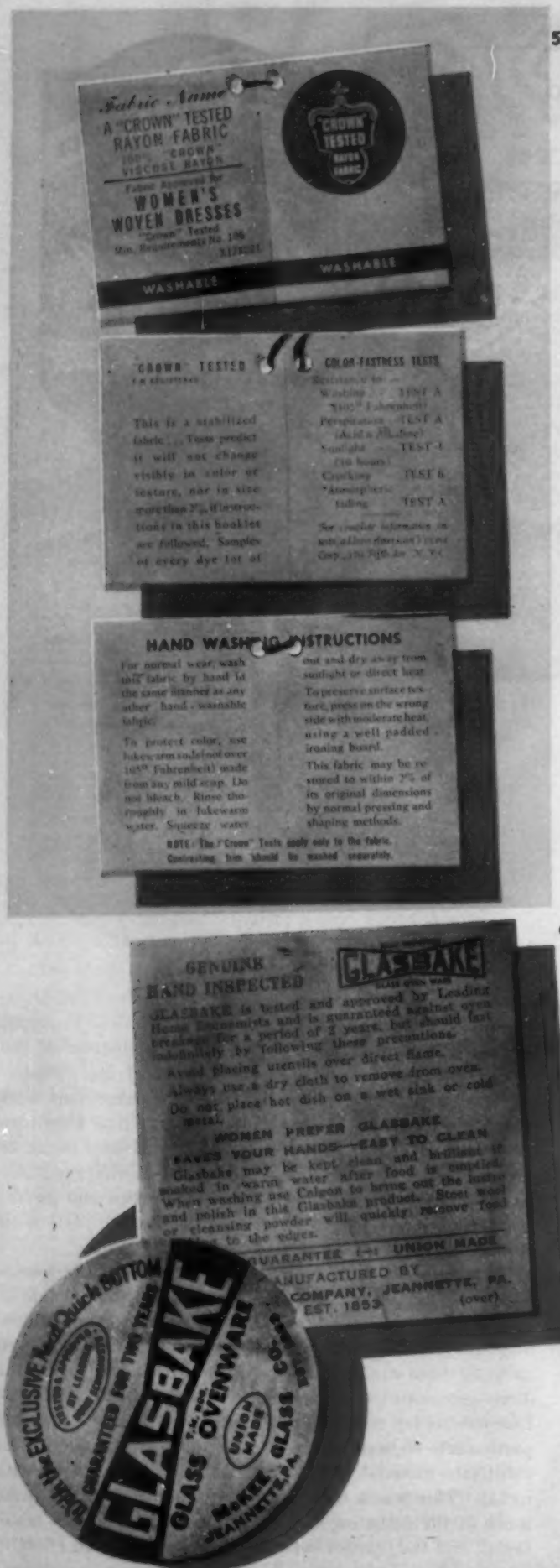
mother found few labeled goods and few qualities to choose from. She judged her lengths of wool, cotton and silk not by a label stating fiber content, but by her own research methods —by twisting, burning, pinching and wetting the material. In judging textiles, she had a long traditional training and a thorough grounding in that most exacting of all testing laboratories—the sewing room at home where in the long winter afternoons she sat with her mother repairing and sewing the family linen. Where labor was plentiful, as in the South, she supervised others in the work, but it was always her department and her responsibility to know textiles, garments and foods, and frequently to manufacture them. In the rural areas she ground her own corn and spun her own flax. She was the repair mechanic in a laboratory where there were only two standards—durability and beauty. And, as there is no one so wedded to quality as a repair mechanic, her standards of quality were rigid. The 20th-Century standards of cheapness (made possible by mass production and frequent replacement of goods) and ease of handling had not yet disturbed her judgments of quality.

But in the last days of the Age of Sail, cheap cotton goods from the Manchester mills relegated spinning wheel and flax to the attic and centuries-old home crafts slowly yielded. In the fashion parade lined up on the cobblestones of the pier at Natchez, Mississippi, to welcome the new steamboat, taffeta petticoats rustled indignantly at the brush of the new cheap gingham skirts and calico kerchiefs.

In the kitchen the new cast iron kitchen utensils simpli-

fied cooking procedure and quickly replaced copper and brass, which had been difficult to keep clean. World War I ushered in an age of alloy steels, and the mass production of the twenties made them available for household use. Housewives began replacing old iron kettles with aluminum ones as they had replaced copper and brass with iron a century before. Stainless steel and chromium plated steel began to appear in the kitchen, too, and the housewife gradually learned via the humble label certain properties and limitations of her new metals—not to scrub chromium plate with abrasives and not to use caustics or lye on aluminum.

In the thirties a new material appeared in the house. Molded phenolics had been produced all through the twenties for commercial purposes, but plastics were not really introduced to the housewife until the early thirties when kitchen gadgets, radio cabinets and cellophane packaging made her dimly conscious that the Age of Plastics had been ushered in. Like most of her reactions to science, this realization was dim, particularly so because she regarded plastics as some sort of substitute material in the fields where they competed with metal. This was a very natural error on her part because much of the designing of the new plastic articles was traditional, and the plastics industry made no concerted effort to



teach her anything about the new materials. Consumer education at the beginning of the 20th Century was left to chance advertising, and plastics, in particular, remained mystery materials, chiefly attractive because of their color.

But the tremendous expansion of consumer goods from 1900 to 1930 created a demand for some definite means of consumer education other than chance advertising. Housewives were unable to identify the new fabrics by the true and tried methods of their grandmothers—by burning threads to see if they gave off the foul smell of pure wool—and anyway it was a little embarrassing to walk through the shops burning threads under the flinty glares of 20th-Century salesgirls!

### Organized information

In response to the demand for consumer information a great many organizations arose after the last war to educate or protect the consumer in the use of his goods. Some were governmental, like the Federal Trade Commission, and others were civic enterprises like the Home Economics Association, which worked on minimum standards, specific labeling of goods, and buying advice for the consumer. Other civic organizations worked on testing and standards for consumer goods, chief among them the American Standards Association, the American Association of Textile Chemists and Colorists, the American Society for Testing Materials, the U. S. Institute for Textile Research and the National Retail Dry Goods Association. The Government, too, leaped into the work of instructing and protecting the consumer with legislation on standards, grades, labeling, inspection and merchandising practice. It set up the Bureau of Home Economics, the National Bureau of Standards, the Bureau of Agricultural Economics, the Consumers' Standards Project, the Consumers' Council of the A.A.A. and, most potent of all, the Federal Trade Commission for the regulation of interstate commerce. In 1937 the most important civic organization from the point of view of informative labeling was set up—the National Consumer-Retailer Council. Its membership includes the most influential consumer and social welfare groups, and several national associations of retailers. Its objects are the promotion of standards, informative labeling and advertising, and the fostering of cooperation between stores and consumer groups. Since its establishment eight years ago, it has become a clearing house of information on consumer buying, and it is the authority on informative labeling.

Another battlement of consumer education was the women's magazines and independent buying guides. Informative advertising done by the women's magazines was perhaps the greatest single influence in the consumer movement. Many periodicals also set up testing laboratories which "approved" or certified branded goods, and while their laboratories did not always have scientific rating, they did accustom the public to the idea of standards. Buying guides, like *Consumers' Research* and *Consumers' Union* maintained testing laboratories and recommended certain products; and although their circulation was not large, their caustic debunk-

5—A rayon manufacturer has set minimum test requirements for the company's fabrics, and gives results of these tests on his labels. Explicit washing instructions are also included. 6—Informative labeling used on most glass kitchenware is well thought of by the retailers

The labels shown in Figs. 7 to 13 are hypothetical, and were written solely for the purpose of suggesting an approach to the subject of informative labeling for plastics products. Factual information to be carried on the label of any given plastic article will, naturally, have to be worked out for that particular article by the materials supplier, the molder and the manufacturer or end seller.

ing of everything from toothpaste to coffee made a tremendous impression. Following the trend of the times, large retail stores established testing laboratories, as did the Underwriters' Association, the American Medical Association and other organizations.

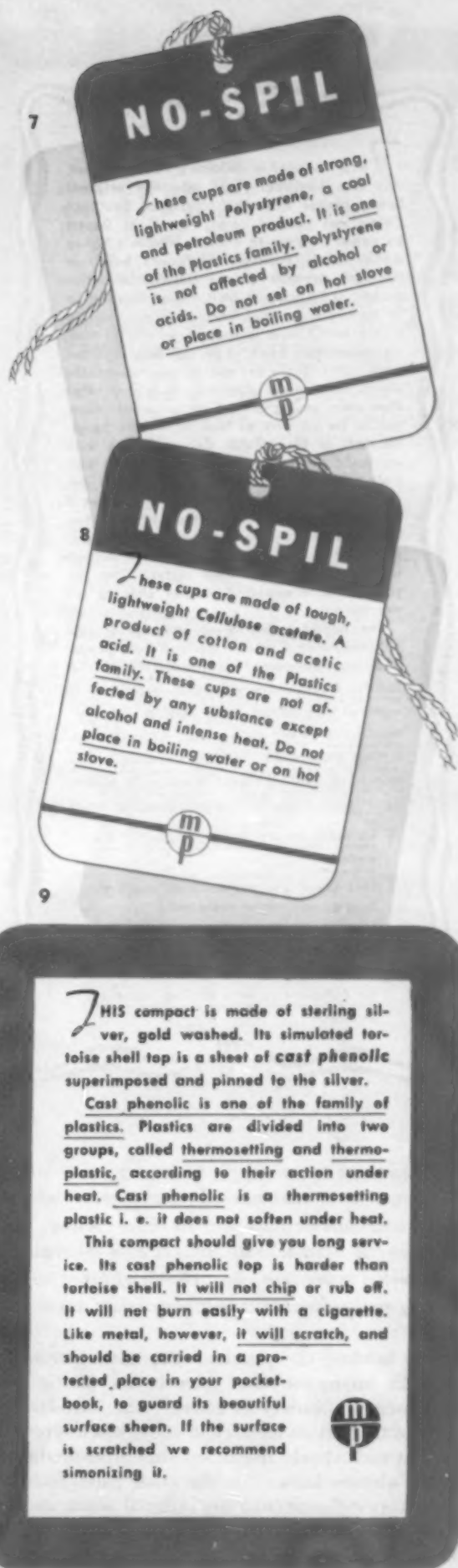
If there were any lingering doubts about the inevitable trend of consumer education in a century so rich in consumer goods as ours, it should be forever laid to rest by the astounding history of the study of home economics in the United States in the last ten years. In an earlier day, this absorbing subject was more humbly called "domestic science" and was connected with little girls sewing rows of lace upside down on kitchen aprons and little boys producing curious monstrosities with hammer and nails. It was, nevertheless, the germ of what we now call "consumer economics" and "home economics." Twenty thousand high schools and land grant universities today have courses in consumption economics which teach the student how to budget the family income.

In these courses the informative label is of more than casual interest: it is looked upon as a pivotal point in educating the consumer. Consumer economics courses study it with a view to budgeting and decisions on quality, while applied chemistry and applied engineering courses in these same departments deal with tests of the goods in laboratories to see whether they conform to specifications of the label. Thus in a study of the "economics of clothing consumption" variously priced cotton dresses are put through washing and other tests to see whether they meet the washing, fading and shrinking specifications of the label, and whether buttons and trim are durable, and trips are made to local shops to study labeled merchandise. Labels with specific technical information are favored and promoted as models of factual advertising, while those which carry only the brand name and advertising are frowned upon.

### Why are labels necessary?

The 20th-Century trend toward consumer education, then, stresses the need for identifying each new material as it appears on the market. In the case of plastics, this need for specific information is much more marked than it is where most new materials are concerned. If these synthetics, differing widely from one another in their properties, are all lumped

7, 8—Labels for the small plastic kitchenwares sold in chain stores should contain simple instructions for their care. 9—Informative label for a relatively expensive cast phenolic compact stresses the point that, like all valuable possessions, it should be well protected



**T**HIS material is Nilatac's honey amber. Five hundred years ago the original honey amber from the forests of Southern China was carried across the Gobi Desert by camel caravan to Venice. Nilatac's honey amber comes, not from the forests, but from the coal deposits of our subsoil, like diamonds. It is brought from closer home than China—from the coal fields of West Virginia where no Chinese is spoken, where, in fact, no camel has been seen for several thousand years. There are footprints on the rocks which may mean that the camels of that date were nosing around for an amber caravan to tie up with or looking for the headquarters of the Nilatac Company. We wish we could meet some of these obliging animals who brought ready made amber. Because we got ours the hard way—we make it by a long recipe in our chemical laboratories. Like those of all famous cooks, our recipe is complicated. Here it is (all but one or two ingredients that we keep secret. After all, you wouldn't expect a master chef to tell everything).

The honey amber brush is made of cast phenolic, a coal product derived from phenol and formaldehyde. It is one of the plastics family. Plastics are classified according to whether they soften under heat or not: thermoplastics soften under heat while thermosetting plastics do not. Cast phenolic is thermosetting. Nilatac's cast phenolic is poured as a liquid into a mold and baked for hours.

Its color, honey amber, is part of the material.

This brush will not crack or swell; its bristles will never come out.

Wash it like any other brush. Do not let it stand in the water, as water roughens its matchless surface.

Do not sterilize with boiling water or alcohol.



10—A paragraph of modern advertising copy introduces the purchaser to a cast phenolic hairbrush. Informative material and instructions for its care follow. 11—Its Army career is used to add interest to a melamine mess tray converted to civilian use. 12—Brief label for acetate measuring spoons might prevent complaints about warping

under the heading of "plastics," the unenlightened public receives the impression that there is one plastic material which comes in a variety of colors. The introduction, for example, of the various metals and alloys was less revolutionary in that each closely resembled some other product which the public already knew. On the other hand, molded phenolic was very different from any material which went before and very different, too, from vinylidene chloride, which also comes under the heading of "plastics." As our British con-

temporary, *Plastics*, says on page 98 of its March issue:

"There is, without doubt, a growing need for the simple and rapid identification of plastics. This need has been indicated by a wide variety of users. . . . The visual distinction between plastics is . . . in many cases difficult. It would tax the ingenuity of most experts to distinguish between many of the transparent plastics and especially between opaque moldings." Recalling that in the early days of the industry anyone with a sensitive nose could distinguish between the different materials because on burning they gave off different odors, the magazine goes on to say that the increase in new materials and in plasticizers makes these tests increasingly unreliable. "Is there a simple and rapid technique for identification possible?" it asks.

The answer would seem to be that there is no authentic visual identification of plastics possible for the consumer except through the adoption of an informative label. Further, as George Scribner, president of the S.P.I., pointed out at the Society's Chicago meeting last month, the informative label will focus the blame for misapplications on the material instead of on all plastics. In experimenting with the new plastics there have inevitably been certain misapplications, with resulting consumer prejudices. If these articles had been labeled "Material X," "Material Y," etc., the customer would thereafter be wary of these particular materials in such applications, but he would realize that the same product might be satisfactory in Material Z.

While there has in the past been informative labeling of plastics in scattered applications such as infants' toys and lighting fixtures, and particularly by nationally advertised companies which do their own molding, the majority of molders do not want to label their goods. Perhaps the most frequently mentioned objection to informative labeling is in the chain store manufactures, yet more prejudice has probably been created against plastics in this field than in industrial goods where the consumers understand the use of the material better. The manufacturers are able to cite several arguments against such labeling, the chief one being that chain stores discourage the identification. It is true that some chains and even large retailers discourage manufacturers' labels, but their objection is not to identifying the material and its proper care; their objection is to identifying the manufacturer, as they wish to keep the source of their buying secret from their competitors.

Another frequently mentioned objection to informative labeling is that the end manufacturer often substitutes materials. In the cases where substitution is possible without deterioration of quality, it is probable that the two materials have much the same properties and need the same care. If, therefore, the cost of printing a new label for each material would be prohibitive, the molder (or the end manufacturer if the molder is not an end manufacturer), should print a general informative label identifying the material only as one of a group of thermoplastic or thermosetting materials with certain properties and certain limitations.

It is stated by some molders that informative labeling has been tried and failed. These conclusions cannot be borne out by any considered research in plastics or any other field. Specifically they seem to refer to certain abortive experiments in furnishing labels by materials suppliers. There are many snags in the way of labels supplied by the materials manufacturer, however excellent his labels. The end manu-

facturer frequently substitutes other material while still using the original label; and manufacturers often regard the use of the materials supplier's label as a gesture in co-operative advertising and expect the materials supplier to pay for the use of his name. In one case labels supplied by a materials manufacturer were declared by the Government to be a hidden subsidy.

These facts indicate that the label should come from the end manufacturer. He alone knows what goes into the finished product, he alone has the contact with the retail outlet, and he alone can properly supply the label. This is a point on which there is absolute unanimity among labeling authorities and consumer buying organizations like the National Consumer-Retailer Council. However, some materials suppliers, particularly in the rayon industry, do successfully supply their own labels. One such company has an elaborate checking system by which they follow their labels through converter and finisher. Each label has its own serial number, and they maintain signed agreements with converters and finishers and a continual check-up—all of which would suggest that while labeling *can* be done by the materials supplier, it is far more difficult to control than if it were in the hands of the end manufacturer. Along with their informative labeling program, this rayon company has one of the most elaborate consumer education programs for schools, women's clubs and stores, for which they provide films, lectures and bulletins. In addition they prepare bulletins on rayon and textiles for technical schools and salespeople. This would seem to be an ideal program for the plastics industry.

During the war, one plastics materials manufacturer embarked on an informative labeling program which he feels has been both necessary and successful. The labels stress the properties and care of the material, identifying it only by trade name. Although these isolated cases prove that labels *can* be supplied by the materials manufacturer, the better and less complicated practice is to have them supplied by the end manufacturer.

Roger Wolcott of the National Consumer-Retailer Council points out many advantages to retailer and manufacturer as well as to consumer from the use of the informative label. Its benefits to the retailer are: 1) that it enables better buying by store buyers, giving them specific standards and information about the product; 2) that it increases sales of better merchandise, the customer preferring quality merchandise when it is proved to him that there is a quality distinction; 3) it trains the salespeople, giving them pertinent facts; 4) it makes for fewer returns and adjustments.

Among advantages to the manufacturer (end seller) from the use of the informative label are: 1) that it enables him to establish his trade name more firmly with consumers since the informative label also carries the name of the manufacturer; 2) it makes for fewer returns and adjustments from the retailer to the manufacturer; and 3) the factual advertising of the label has more present-day glamour than any other type of advertising. For instance, many wool distributors feared that the passage of the Wool Labeling Act might cause customers to be suspicious of merchandise made of reprocessed or reused wool, however serviceable. In the glamour advertising of the wool manufacturers, the words "reprocessed" or "reused" had never been employed and to the average consumer they conveyed only a vision of the

11  
**T**HIS tray was designed for the U.S. Army. Thousands were used in Army camps all over the country and some even saw service in the canteens behind the front.

We recommend this tray for use as an hors d'oeuvres tray or as a nursery tray for the children's meals. Let the baby drop it or hammer on it with her spoon—it will come out unscathed. It is specially designed for strength, durability, and non-scratching qualities. It can be put through the dish washing machine without losing its glossy surface and it can be dropped without breaking.

The tray is constructed of melamine, one of the thermosetting plastic materials. (Plastics are thermosetting or thermoplastic according to whether they soften under heat.) It has superior heat resistance, will not absorb water. Its filler is cotton rag which gives added strength.



12  
**T**his is tough, unshatterable Cellulose acetate, made from cotton and acetic acid. It is one of the Plastics family. Wash with soap and water. Do not use boiling water or alcohol on these spoons.



ragman with his poor, thin horse and cart full of junk. The informative label (as well as the exigencies of war) did much to overcome this prejudice, and today "reprocessed wool" appears in the best circles.

The most obvious advantages of the informative label are, of course, to the consumer who, in learning from the label the hidden qualities of the merchandise, is able to choose the article best suited to his needs, and in learning the use and care of the article, is able to save money. Other advantages are that he saves time in shopping and learns to appreciate quality merchandise.

(Please turn to next page)

**T**HIS bar, you will say, looks like white mahogany, but when you feel it, it is as hard as a slab of petrified wood.

It is not a mahogany. It is a phenolic laminate. To make it, sheets of sugar maple plywood were impregnated with a plastic resin and fused under heat and pressure into a hard slab. A sheet of white mahogany was laid on top before fusing to give the grain the smooth texture of mahogany. The plastic resin used in the laminating of this bar is phenolic resin, a coal product derived from phenol and formaldehyde. Phenolic laminate is insoluble and infusible; it is classified as one of the thermosetting plastics because it will not soften under heat.

This phenolic laminated bar is stronger than the petrified wood it resembles. It is not affected by substances which injure ordinary wood—oil, fruit juices, acids, and moisture. Alcohol will not stain it. Cigarettes will not burn it. Its deep luster will not scratch or blur.

We think you will find it the ideal bar.



13—Label to be attached to a cocktail bar of laminated phenolic material explains briefly how it is made, and tells why the manufacturer thinks his product is superior to a similar bar made of wood

### Types of informative labels

Although it is generally agreed that informative labeling is here to stay, there is no general agreement as to the best type of informative label. On the subject of how much technical information the label should carry, there are two schools of thought. Consumer leaders and the National Consumer-Retailer Council favor a completely informative label giving specific test data where recognized standards are available. The points to be covered by this type of technical label are outlined by Mr. Wolcott in his excellent Master Label Outline (see page 170). The six points to be kept in mind are the performance, composition, construction, care and use of the article, and the name of the manufacturer. Manufacturers using this type of label can have their labels approved by the Council and the Council's endorsement printed below: "This is the type of label recommended by the Consumer-Retailer Council, Inc." The Council's endorsement is a valuable asset on informative labels, and many famous labels such as the Chatham, Pacific Mills and Sears, Roebuck labels carry it. In addition, the Council offers a consulting service, and has a labeling committee of consumer, retailer and manufacturer representatives who will, on request, write labels.

In defense of a highly technical informative label containing specifications and test data which the average consumer does not understand, Mr. Wolcott points out that the specifications, even when not understood in detail, are useful as a basis of comparison between low- and high-priced goods. When it is stated that a 19-cent towel absorbs 30 oz. of water per sq. yd. and a 35-cent towel absorbs 40 oz., and a 59-cent towel 55 oz., the customer is persuaded that the more expensive towel has a quality difference. The Council points out, too, that labels which carry technical information are the trend of the times and have the benefit of promotion in the schools and colleges where they are studied.

Representing the other school of thought, many retailers

and educators believe that the label should express merchandise quality in *general* rather than in technical terms, and they point to the success of stores like Macy's in New York City which have translated the technical specifications of the label into terms the consumer can understand. Thus in labeling raincoats, Macy's translates the mathematical terms of water resistance into simple words indicating degrees of permeability, such as "water repellent," "water resistant" and "waterproof." For many plastic consumer goods, this is the best procedure, since figures designating, for example, the tensile, impact and flexural strength of a given plastic mean little to the layman. Authorities who hold for briefer and less technical factual labels say that, particularly in the chain store, the customer has neither time nor inclination for reading technical labels. She wants to know only how to take care of the article and how to make it last.

### How should plastics be labeled?

The question of how much technical information the label should bear is particularly important in plastics where the technical information involved is altogether new to the public. Common sense should be the criterion. Remembering that in dime store merchandising the consumer has no inclination for technical reading on items which she regards as merely temporary expedients, the molder (or the end selling organization) should remember, too, that the middle- and upper-class housewife who can afford luxury goods has been trained to believe that the label which carries technical information is an authoritative analysis and a guarantee which she accepts uncritically. He should not forget that science has invaded the drawing room and the women's clubs, and that at every bridge table there sits a lady who is a devotee of science and to whom the words "thermoplastic" and "thermosetting" are a heaven-sent message which she will explain many times over to (Please turn to page 168)

# A new name among vinyl resins

by M. SCOTT MOULTON\*

COINCIDENT with the development of a series of vinyl-vinylidene chloride copolymers, the name "Geon" (pronounced jē'-on) has been selected to designate an entire family of polyvinyl resins presently including the new copolymers as well as two grades of polyvinyl chloride. These copolymers were developed specifically to furnish resins combining the unusual stability and chemical resistance of polyvinyl chloride with the solubility and plasticity essential to certain processing operations, particularly in the coating field. These copolymers round out the uses of vinyls to the point where they encompass nearly all possible methods of resin application. Compounded Geon resins can be calendered, extruded, molded, cast or applied to supplementary materials for extended applications by means of such methods as spreading or dipping, or by the use of various processes of impregnation.

Although in normal usage polyvinyl resins are thermoplastic, with the addition of certain thermosetting polymers such as N-type synthetic rubber "Hycar OR," they can be vulcanized. Blends<sup>1</sup> containing from 75 parts Hycar and 25 parts Geon to 50 parts Hycar and 50 parts Geon are easily processable and, when vulcanized, yield products serviceable

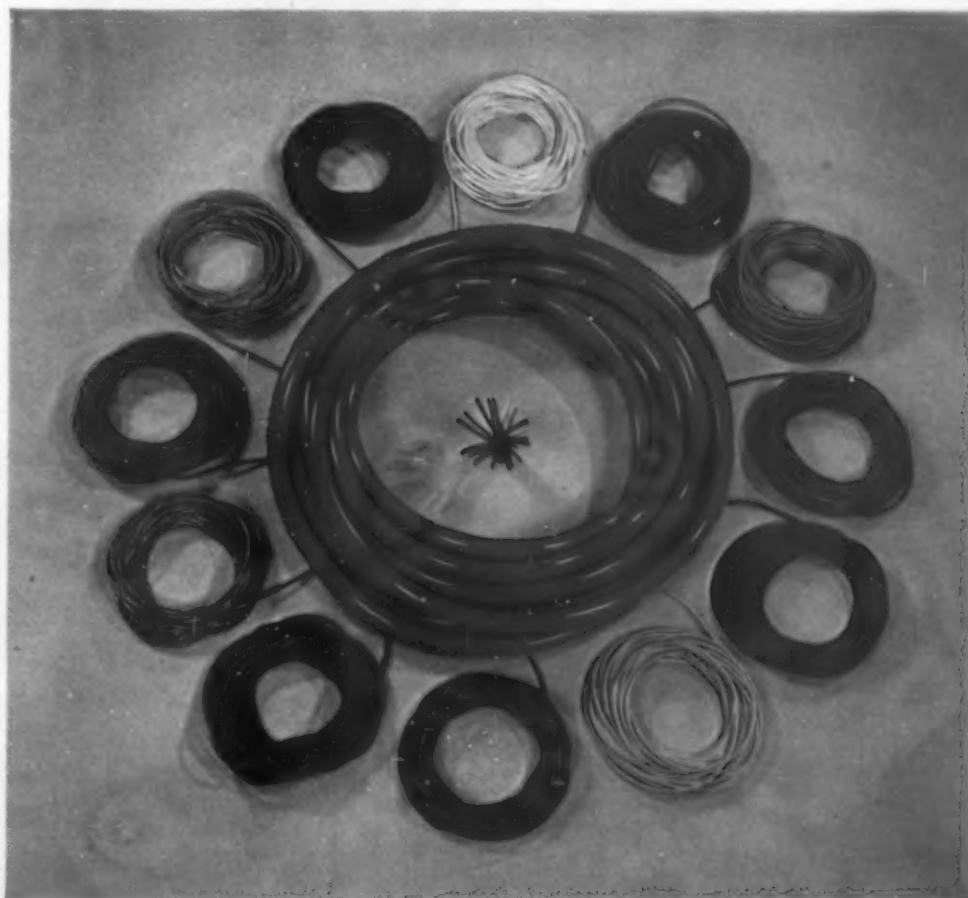
over an exceptionally wide temperature range. In the 75-25 blends the resin addition has very little effect, as compared with butadiene synthetic rubber compounds, on such mechanical properties as tensile, elongation, set, rebound and cold flow. In addition, these blends enjoy the sunlight-, ozone-, flexing-, tearing- and benzene-resistance characteristics of the polyvinyl resins. Compounding is more like that for butadiene synthetic rubber than for vinyl resins, and there is relatively high tolerance for pigment loading, with specific advantages to be gained in most cases from such loading. Frequently the plasticizers can be of types not regarded as first choice for vinyl resin compositions, and extenders such as Cumar, coal tar and other softeners can generally be employed to excellent advantage as aids in processing these materials.

Except for unusual applications, polyvinyl chloride must be plasticized to be serviceable, and it was on the basis of Dr. Waldo Semon's discovery<sup>2</sup> and exploitation of this possibility that the non-rigid vinyl chloride plastics were developed. The vinyl chloride monomer for these resins is made by direct combination of acetylene and hydrogen chloride.<sup>3</sup> Polymers are produced by emulsion polymerization, a process

\* Technical service engineer, Chemical Div., B. F. Goodrich Co.  
<sup>1</sup> U. S. Patent No. 2,330,353.

<sup>2</sup> U. S. Patent No. 1,929,453.  
<sup>3</sup> U. S. Patent No. 2,225,635.

1—Brilliant red garden hose of extruded polyvinyl resin encircles electric cable designed to simplify tracing of lines. Surrounding the hose are coils of colored insulating wire





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TABLE I.—PROPERTIES OF GEON RESINS

Geon number	Specific gravity	Average acetone extract	Average specific viscosity <sup>a</sup>	Recommended solids in m.e.k. <sup>b</sup> at 20° C.	Recommended solids in m.e.k. <sup>b</sup> at 70° C.	Plasticizer index <sup>c</sup>
		%		%	%	
101	1.40	15	.55	4.5	12	43
102	1.40	14	.59	4.5	12	43
202	1.42	48	.40	8	17	34
203	1.43	56	.36	14	25	31

<sup>a</sup> At 20°C. of 0.4 percent solution in nitrobenzene.<sup>b</sup> Methyl ethyl ketone.<sup>c</sup> Parts of dioctyl phthalate per 100 parts Geon to give comparable hardness at room temperature.

which consistently yields resins of superior electrical properties, stability and uniformity. Geon resins are subject currently to allocation under General Preference Order M-10.

Because the physical properties of plastics are closely dependent upon the specific composition and processes used, the characteristics of Geon plastics as presented in Table II are described somewhat generally. More detailed information will be presented in a technical handbook. Plasticizing of these resins can be accomplished with any of a number of common materials, of which the following are examples:

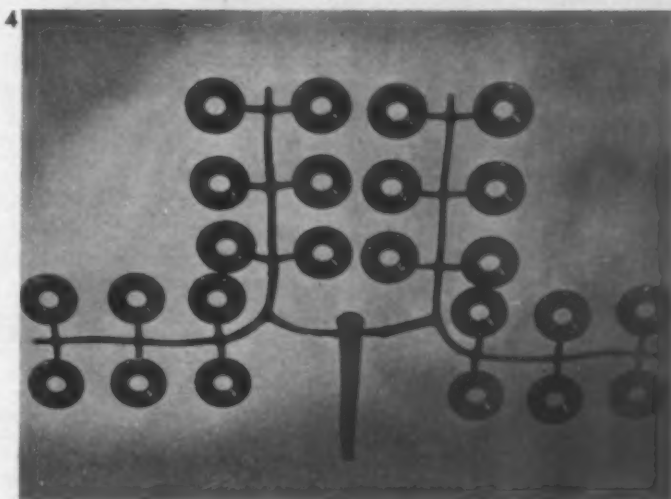
Material	Characteristics imparted
Tricresyl phosphate	Non-flammability and resistance to corrosion
Dioctyl phthalate <sup>4</sup>	Electrical properties and low brittleness temperature
Dibutyl phthalate	Flexibility at low temperatures
Butyl phthalyl butyl glycolate <sup>5</sup>	Suitability for use with food products
Hycar OR	Non-volatile plasticizer
Triglycol ester <sup>6</sup>	Transparency and flexibility at low temperatures

In many cases, combinations of the plasticizers that are mentioned above or of other plasticizers will furnish desired results. In leathery compositions, Hycar serves as a non-extractable wholly adequate plasticizer with no liquid plasticizer added. Excellent thin calendered films have been produced using this synthetic rubber to replace half of the usual liquid plasticizer. Compositions of this type can be employed to great advantage where steam sterilizations must be withstood.

These resins are notable for their resistance to heat and light, and under normal conditions of service the use of stabilizers is not essential. Nevertheless, in general compounding the addition of such stabilizing agents as lead silicate<sup>7</sup> and basic lead carbonate is advised. In general, the addition of fillers to thermoplastic materials results in a lowering of properties. Exceptions to this generalization are the usual increase in resistance to heat deformation and, in the case of certain pigments, an increase in tensile strength. Hycar OR, some of the alkyds and resinous derivatives of

<sup>4</sup> U. S. Patent No. 2,325,951.<sup>5</sup> Monsanto "Santicizer B-16."<sup>6</sup> Drew Plasticizer "SC."<sup>7</sup> U. S. Patent No. 2,179,973.

2—This gleaming white handbag is indicative of the possibilities for luggage and furniture coverings of calendered polyvinyl resin. The colorful fabrics were dip coated in solutions of these resins. 3—These articles, which were molded of polyvinyl resin, include a ball valve, boot, sealing rings, pedal cover, suction cap, grommets and other miscellaneous industrial products. 4—These grommets were injection molded. 5—Calendering and molding techniques were employed in making the soles, heels, welts and uppers of these shoes from vinyl resins



```
graph TD
    subgraph Left_Path [Left Path]
        Salt1[Salt] --> Chlorine1[Chlorine]
        Water1[Water] --> Hydrogen1[Hydrogen]
        Chlorine1 --> HCl[Hydrogen Chloride]
        Hydrogen1 --> HCl
    end
    subgraph Middle_Path [Middle Path]
        Coke[Coke] --> CaC2[Calcium Carbide]
        Limestone[Limestone] --> CaC2
        CaC2 --> Acetylene[Acetylene]
        Acetylene --> VC[Vinyl Chloride]
    end
    subgraph Right_Path [Right Path]
        Salt2[Salt] --> Chlorine2[Chlorine]
        Water2[Water] --> Caustic[Caustic]
        Chlorine2 --> TE[Trichlor Ethane]
        Caustic --> VC2[Vinylidene Chloride]
    end
    VC --> GEON100[GEON 100 SERIES RESINS]
    VC2 --> GEON100
    VC2 --> GEON200[GEON 200 SERIES RESINS]
    GEON100 --> GEON_PLASTICS1[GEON PLASTICS]
    GEON200 --> GEON_PLASTICS2[GEON PLASTICS]
```

The flowchart illustrates the production of GEON plastics from various raw materials. It is divided into three main paths: Left Path, Middle Path, and Right Path.

**Left Path:** Salt and Water are processed to produce Chlorine and Hydrogen. These combine to form Hydrogen Chloride. Hydrogen Chloride, with the addition of Catalysts, produces Vinyl Chloride.

**Middle Path:** Coke and Limestone are processed to produce Calcium Carbide. Calcium Carbide, with the addition of Water, produces Acetylene. Acetylene, along with Vinyl Chloride, produces Vinyl Chloride.

**Right Path:** Salt and Water are processed to produce Chlorine and Caustic. Chlorine, along with Vinyl Chloride, produces Vinyl Chloride. Caustic, along with Vinyl Chloride, produces Vinyl Chloride.

**Final Products:** Vinyl Chloride is used to produce GEON 100 SERIES RESINS. Vinyl Chloride and Vinyl Chloride are used to produce GEON 200 SERIES RESINS. Both GEON 100 SERIES RESINS and GEON 200 SERIES RESINS are used to produce GEON PLASTICS.

**Additional Information:** The GEON 100 SERIES RESINS and GEON 200 SERIES RESINS are further processed with Plasticizers, Stabilizers, and Pigments to produce GEON PLASTICS.

**Electrical service**—Control, power and communication wire and cable insulation for ships, tanks, aircraft, motor vehicles, public service equipment and other uses where insulated conductors are required. Cable (*Please turn to page 162*)



6—These compression molded articles include part of a commercial orange-juice extractor, an oil pump valve and a large closure ring. A more thermoplastic polyvinyl resin was used in the manufacture of the hard chemically resistant ladle. 7—The two sets of garden hose couplings shown at the upper left were injection molded. The other items, which were compression molded, include electrical plugs and jacks and a shoe heel

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# SOCIETY *of the* PLASTICS INDUSTRY

## Annual Conference

WHILE the Annual Plastics Conference of the Society of the Plastics Industry was held on Thursday and Friday, May 11 and 12, at the Edgewater Beach Hotel, Chicago, Ill., the semi-official opening took place on the night of May 10 when the Plastics Pioneers held their yearly dinner. Following the election of Herbert Spencer, of Durez Plastics and Chemicals, Inc., as president of the Pioneers for the coming year, members of the industry who died during the past year were commemorated. Alan S. Cole, general manager of MODERN PLASTICS magazine, was in charge of the entertainment for this meeting of the "old timers." The Thursday morning session was presided over by L. H. Amrine, Imperial Molded Products Corp., while Norman Anderson, General Molded Products, Inc., was chairman of the luncheon meeting at which the John Wesley Hyatt Award was presented to Dr. Stuart D. Douglas, head of Plastics Research, Carbide and Carbon Chemicals Corp. In the absence of Bradley Dewey, Rubber Director, who was detained in Washington, John Caswell, Special Representative, Office of Rubber Director, read the scheduled speech on "The Synthetic Rubber Program." Following the first afternoon session, at which William K. Woodruff, Celanese Celluloid Corp., presided, the motion pictures, "Shape of Things to Come" and "The Formica Story" were presented by Boonton Molding Co. and the Formica Insulation Co., respectively. George K. Scribner, president of S.P.I., was chairman of the Thursday evening banquet at which W. D. Fuller, president, Curtis Publishing Co., and past president, National Association of Manufacturers, spoke on the "Road to Postwar Opportunities." The presiding officer at the second morning meeting was James Johnston, Chicago Molded Products Corp., and Paul C. Tietz, Richardson Co., was chairman of the luncheon session which followed. Friday afternoon was devoted to four division meetings: the Molder's Division, which was presided over by J. D. McDonald, McDonald Manufacturing Co.; the Machinery and Tool Division, for which F. G. Schranz, Baldwin Southwark Div., Baldwin Locomotive Works, was chairman; the Button Division, presided over by N. O. Broderson, Rochester Button Co.; and the Extrusion Division, for which Elmer Szantay, Sandee Manufacturing Co., was chairman. The late afternoon was devoted to a business session. At the banquet which brought the convention to a close, Elmer E. Mills, Elmer E. Mills Corp., introduced the two speakers of the evening: Colonel Ilia M. Sarayev, Military Attache, Union of Soviet Socialist Republics, who spoke on "The Soviet Union Front Today"; and Dr. Preston Bradley, author, speaker and radio commentator, who talked of "What Are We Facing." Résumés of the speeches delivered at the sessions are presented on the following pages.

In a talk entitled "Informative Labeling," George K. Scribner, president of Boonton Molding Co., discussed the advantages to the plastics industry in goodwill and purchaser security—factors which will ultimately influence the success or failure of plastics with the consumer—of labeling products made of plastic materials.

While purchasers will not condemn all metals because of the failure of one application, because they have learned that there are a number of metals, each with valuable qualities, they will and have condemned all plastics because of an unfortunate experience with one, even though the material itself was not at fault but rather its application was unwise.

This situation could be remedied by educating the public to the fact that there are a number of plastics, each with its own set of properties and each excellent in its particular fields of application. This might best be done by shortening highly technical names to easily pronounced and remembered forms and by labeling each plastic item with its generic name in addition to the trade name so that the purchaser would know instantly whether it was made of a material which he had been previously advised was suitable for that type of application. Specifications were not immediately essential on these labels, although their addition might prove beneficial at some future time. The important thing was to teach the public to distinguish among the various types of plastic materials by giving each plastic article its own generic name, shortened to an easily remembered form such as acrylic plastic, butyrate plastic or styrene plastic.

The plastics industry, which has greatly increased its volume of production during the war period may, according to estimates

prepared by the Committee for Economic Planning, expect a 50 percent cut. Cash reserves should be built up accordingly. Engineering ability is what will count from now on.

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"Plastics Materials Availability and Distribution" was the subject chosen by Grayson W. Wilcox, Assistant Chief, Plastics Branch, Chemicals Bureau, WPB, who also discussed allocation orders, machinery, and conversion to peacetime production.

Over-all availability of plastics materials for each end use has remained relatively unchanged during the last 6 mo., and it is hoped that end use coverage can be maintained for some time to come. Direct allocation of some resins has resulted in equitable distribution and has had real advantages in many cases. The "previously authorized" provisions of Order M-246, which provide for small, unpredictable requirements, may be incorporated into other control orders if they are not abused. M-300 is the framework of a basic allocation order under which many commodities could be distributed instead of under individual orders.

New facilities for the industry must still be considered on the basis of their contribution to winning the war until the turn of events in Europe assures a speedy victory. On the whole, as long as wartime restrictions remain, new machinery will be allocated to established plastics firms rather than to newcomers. Deviations from this policy in a few instances have been caused by reluctance of the former to accept important war contracts.

Reconversion will begin gradually as war procurement is cut back and Government orders relaxed. (Please turn to next page)



*R. Kinnear, G. K. Scribner, M. M. Makeever, J. B. Neal, N. A. Backscheider, K. H. Braithwaite, H. S. Bunn*

"The Significance of New Data on Combinations of Plastic and Glass Fibers," was analyzed by Frank Preston, Preston Laboratories. Basing his talk on a series of papers on Fiberglass which appeared in the May issue of *MODERN PLASTICS* magazine, Mr. Preston emphasized the fact that, in this material, the glass is the primary element and the plastic secondary, since the material is actually a plastic-supported glass net and not a plastic with a glass filler.

The properties of glass are based on the properties of silica which is the major component of its structure. The most advantageous of these properties is strength; the least desirable are its brittleness and moisture absorption. Before it can be combined satisfactorily with plastics, the glass is first fibered and coated with an oily film, and then woven into glass cloth. The lubricant is then removed together with as much of the moisture as possible so that the plastic can get up to the glass interface to give continuous support to the fibers. Only in this way can the great strength which is inherent in the combination be developed. The plastic protects the glass from abrasion and acts as a bridge to transfer stress from one fiber to the other. The result is a strong, flexible, shockproof structural material of great merit that is capable of being shaped into slender, lightweight complex forms with rounded contours, reversed curves and general streamlined qualities.

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Dr. J. J. Pyle, Director of the Plastics Laboratory, Plastics Divisions, General Electric Co., in his address on "Recent Developments and Their Effect on the Plastics Industry," offered the three following developments as factors which may be expected to have profound effect upon the scope and direction of the plastics industry in the postwar world: 1) increased production and reduced cost; 2) new applications which have opened up new markets; and 3) new and improved materials.

Styrene has had a phenomenal increase in production since the outbreak of hostilities. After the war, a considerable quantity of this material will undoubtedly be diverted from the manufacture of synthetic rubber to the manufacture of plastics. Already prices have begun to drop, and certain undesirable mechanical properties will without doubt be overcome. Vinyls have also experienced considerable expansion during the war as a substitute for rubber. How much of this field the vinyls can hold when low-cost synthetic and natural rubbers become available depends to a great extent upon how much they are reduced in price. While acrylates and polyvinyl acetals have also enjoyed considerable expansion, the chemistry of the manufacturing process appears somewhat complicated and marked price reductions do not appear to be in the cards.

New and improved plastics materials have been developed for certain physical or mechanical properties; to synthesize new chemicals which are capable of undergoing polymerization in condensation to yield previously unknown resins; because of a change in manufacturing technique; or to counteract certain

objectionable characteristics so that other useful properties could be utilized.

The chief competition for low-pressure molding will undoubtedly come from the post-forming of flat laminates. It was suggested that if widespread use of lignin is to be achieved, certain modifications of pulp procedures will be necessary to produce useful pulp and usable lignin products.

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A paper entitled "Polyfibre—A New Approach to Plastics Molding," by W. C. Goggin, manager, and R. R. Bradshaw, molding engineer, of the Plastics Development Division, Dow Chemical Co., was read by Mr. Bradshaw.

A light structural material which may be molded by new methods into strong articles with densities as low as 0.4 is Polyfibre, one form of which is based on polystyrene. Composed of fine, highly oriented fibers ranging in size up to 5 microns in diameter, this material accomplishes the dual purpose of exhibiting a large surface area per unit weight and thus absorbing heat rapidly, and of tending to shrink when subjected to heat so that in itself it exerts most of the pressure necessary for fabrication. It is at present supplied in its simplest form as a bat, 14 in. wide and approximately 10 ft. long, of parallel fibers running crosswise to the bat. When the fibers are not tightly packed, Polyfibre is a good low-temperature thermal insulation and sound insulation medium. Tight packing and evacuation of air give a molding material which, because of its large fiber surface, absorbs heat quickly and thus requires a relatively short molding cycle. The material's inherent shrinkage makes it unnecessary to use high molding pressures.

It may be molded by compression or by low-pressure bag methods. The bats may be laid up in a number of ways, according to the direction in which strength of the finished part is desired. Four variables pertaining to the molding cycle—time, temperature, pressure and solvent content of the fiber—control the density and consequently the ultimate properties of the molded parts.

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A. J. Monak, chief engineer of Mycalex Corp. of America, discussed "Properties and Applications of Mycalex."

Properties now demanded of electrical insulation, particularly loss factor at ultra frequencies, have made materials customarily used for insulation unsuitable for many present-day applications. A low-loss (0.014 at 1 megacycle) material which meets rigid insulation requirements is Mycalex, a glass-bonded mica, most of which comes in smooth-surfaced sheets, rods, disks and simple irregular shapes which may be machined by ordinary equipment. Transfer (sometimes called injection) molded Mycalex requires no machining and inserts may be molded in.

Mycalex is used where such characteristics as low loss factor, high dielectric strength, close tolerances, dimensional stability, ability to withstand temperatures up to 425° C., resistance to



*G. H. Clark, E. W. Halbach, W. I. McCortney, E. E. Mills, P. C. Tietz, F. G. Schranz, R. L. Peat*

tropical temperature and humidity, absence of carbonization in case of arcing and negligible water absorption are required. Typical applications have been panels, coil forms, switches, relays, couplings, antenna insulators, arc deflectors and magneto parts. Its cost is somewhat higher than that of most organic plastics, but difference is counteracted if the material fills specific needs.

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The versatility of vinyls was discussed by M. Scott Moulton, technical engineer, plastics materials, Chemical Div., B. F. Goodrich Co., in a paper on "Geon Resins." "Geon," a name chosen to designate an entire family of polyvinyl resins, includes two new copolymers of vinyl-vinylidene chloride and two types of polyvinyl chloride. The copolymers are more thermoplastic and more soluble in the customary solvents than the straight polyvinyl chlorides. However, with the addition of compatible thermosetting polymers such as certain synthetic rubbers, the normally thermoplastic polyvinyl resins can be vulcanized. The properties of these resins are such that the resistance of synthetic rubber to sunlight, ozone, aromatic hydrocarbon, tear, flex and aging is improved in blends of polyvinyl resins and synthetic rubber. The compounded resins can be calendered, extruded, molded, cast or applied to supplementary materials by spreading, dipping or impregnation. When converted to plastic compositions, the resulting material can be compression or injection molded or made into tubing or channels. [Other properties of this vinyl group and numerous applications are detailed in the article, "A New Name among Vinyl Resins," which appears on page 83 of this issue—Ed.]

• • •

"Polyethylene—A New Dielectric for Cables," was the title of a paper presented by H. B. Slade, research engineer, and H. C. Crafton, research chemist of the Okonite Co.

Published literature relating to the subject was summarized, followed by a brief historical comment on the polymerization of ethylene, a discussion of the molecular structure of polyethylene, its properties, and the interrelationship of structure and properties. The conditions for the polymerization of ethylene in the manufacture of polyethylene are unusual. They involve extreme pressures and heat formerly unheard of in commercial scale processes. The fundamental structure and behavior of polyethylene bridges, in some respects, the gap between rubbers and plastics. Many of its properties are superior to those of either. Being a single flexible material, with no plasticizers or other processing materials (with the slight exception of the antioxidant), it has a great advantage over its contemporary competitors.

At the present time, polyethylene is being used mainly for high-frequency cables where its low losses and general physical and chemical properties are unequaled by those of any other material. Other uses are being developed, among them radio, communication, control and submarine cable, all for military use.

Immediately after the Friday luncheon, Alternate Chairman N. J. Rakas, Plastics Rubber Laboratory, Chrysler Corp., presented a digest of the Technical Committee Progress Report. The full report was distributed in pamphlet form to all members at the beginning of the session. Mr. Rakas delivered the talk in the absence of General Chairman W. J. McCortney of Chrysler.

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At the end of the broadcasting of "Little Resin Riding Hood," the skit presented by MODERN PLASTICS magazine, George K. Scribner of Boonton Molding Co. discussed briefly the dangers inherent in such stratospheric flights of ignorant imagination as were incorporated in the radio program, with regard to what plastics can do. The logical solution to this exaggeration regarding the industry would seem to be a permanent public relations department at national headquarters, a department that can be in touch with radio stations, magazines, newspapers all over the country and certify to the reputations of the speakers or the contents of scripts and articles.

• • •

Sidney S. Ullman, Office of Price Administration, addressed the Molder's Division on "Maximum Price Regulation 523."

Regulation 523, which was effective March 27, an all-inclusive order, may be considered a rule book for molders. A step toward simplification, it divides all plastics into two classes, 1) those sold during the first three months of 1942 and 2) those not marketed during that period. For Class 1, it establishes as the maximum price for a molded product, that charged on March 31, 1942. If no list price was in effect at that date, the maximum price should be the last at which the product sold during the three-month period.

Prices for Class 2 are established by freezing price methods and rates. A production run should be used to check estimates of prices. This order simply establishes for plastic products the same provisions which apply to tools and dies under MPR-136, which covers material costs, labor rates, overhead and profit rates, using the same base date, so there seems no reason for objections to it.

In a discussion following his talk, Mr. Ullman answered questions about the operation of the order.

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Also a speaker at the Molder's Division meeting was James A. Lawton, of the War Production Board, whose topic was "The Current Plastic Machinery Situation."

Under Order L-159, certain machinery builders have been given permission to build machines in lots of 5 or more in anticipation of war orders so that molders can secure faster delivery. Some builders were not fair in this respect, and an impression has in some cases been created that these machines could be used on non-essential work. On the contrary, the order will be tightened, since there is no great inventory of plastics items essential to the

war and the stiffest fighting is still ahead. Justifiable needs for machinery for war work will be granted.

• • •

The necessity for developing improved manufacturing methods which will place plastics on a competitive basis with other materials in the postwar world was the theme of a talk delivered at the Molder's Division by George W. De Bell, consulting engineer, on "New Developments in Molding Equipment." Beginning with the storage of plastic materials and continuing through to molding, the deficiencies of present processes were discussed and changes were suggested which would aid in lowering operating costs and speeding production. Advisability of predrying most thermoplastic and thermosetting materials was considered and the suggestion was made that manufacturers of predrying equipment furnish charts showing performance of their machines under varying conditions and with various materials.

If the proper type of molding materials can be developed utilizing the new types of thermosetting resins, increased use of cold molding may well prove the answer to rapid, cheap fabrication. Machinery manufacturers should give special consideration to the design of a turret type of cold molding press.

The advent of electronically heated preforms has made faster acting compression presses desirable in order to avoid delay between the end of the preheating cycle and the beginning of the pressure cycle. As an aid in speeding production, the use of an overhead ram press with a bedplate incorporating the shuttle carriage and arranged so that knockout action could take place either in the molding or stand-by position, was suggested.

For many transfer molding operations it should be feasible to use a double-action, overhead hydraulic ram press such as that employed in sheet-metal stamping and forming operations. In this molding unit, the fixed half of the die would be mounted on the bedplate, with the moving half carried by the overhead clamping cylinders. The injection, or pot cylinder, would be carried by the moving platen or mounted on the press head as a follow-up cylinder.

Injection molding units of the future should include efficient cooling water distribution and volume control. The most important improvements in extrusion molding will come in the more complete control of dimensions and shapes, the maintenance of closer tolerances, and the ability to produce more uniform surface appearance.

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Speaking before the Machinery and Tool Division, James Neal, Norton Laboratories, divided his talk on "What Do We Expect" into two sections—"what is the molding industry" and "where is this industry today?"

Because of the glamour with which the plastics industry has been surrounded, a large part of the general public has come to believe that almost everything can be molded from plastics. It is essential that general recognition be given to the distinction between the molding of plastics and the much broader field covering all applications of plastics.

At the present time approximately 50 percent or \$75,000,000 of the sales of the molding industry can be credited to war business. While our finances are in seemingly good order, the industry has not been able because of the tax structure to accumulate large reserves.

In the postwar world the molders and machinery manufacturers must cooperate if the greatest measure of prosperity is to be achieved. While machinery builders can secure substantial sales by selling pressing equipment to everyone who is interested in the plastics business regardless of his background and financial status, in the long run this practice will tend to demoralize the industry. The possibility of cross-licensing of patents among machinery builders was proposed. Another point of interest to the molder is the possible development of improved preform equipment.

The Button Division held a short closed business session. To permit members if they so desired to attend sessions being held by other Divisions, this meeting started early in the afternoon.

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In his speech on "Recent Developments on Extrusion of Polystyrene" delivered before the Extrusion Division, J. A. Palmer of Dow Chemical Co. said that there were certain to be unpredictable and unchartable changes in an industry that has grown from 19 to 43 firms since 1940 and from 50 to 364 machines. In order to produce the many new applications that have been found for extruded products and to take advantage of those new raw materials that are particularly applicable to the extruding process, the extrusion branch of the industry is certain to increase in size. Attention was directed to development of thermosetting extrusion and improvement in machines. Research now under way should soon develop a pattern for faster and more uniform extrusion.

At the conclusion of Mr. Palmer's speech, Elmer Szantay, chairman of the group, told members that plans to revise the S.P.I. extrusion booklet on standards had been held in abeyance until completion of the new booklet by the S.P.I. Technical Committee. He asked that members give careful consideration to the mimeographed report form on dimensional tolerances for extruded plastics.

The announcement was made that R. P. Allen had left the industry and members were urged to suggest nominations to the post of vice-chairman left vacant by Mr. Allen. An Advisory and Policy Committee consisting of the following members was announced: Elmer Szantay, Sandee Manufacturing Co.; Chas. Slaughter, Extruded Plastics, Inc.; J. Frank, Gemloid Corp.; J. E. Gould, Detroit Macoid Co.; E. B. Crawford, Auburn Button Works, Inc.; Douglas Ward, Fibron Sales Division of Irvington Varnish & Insulator Co.; and E. E. Kotkin, Plastic Process Co.

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E. M. Houts, Allocations Officer of the WPB's Chemical Bureau, who addressed the Business Section on "Plastics Materials Allocations," congratulated the plastics industry on its record of 90 percent production for war, distributed among all branches of the Armed Services.

When the WPB established the Chemicals Bureau to assist all war industries in obtaining their equitable share of the available materials, the handling and administration of approximately 130 chemical orders and 130 allocation orders needed to control some 4000 commodities was assigned to the Allocations Office. The Office, which handles as much as \$145,000,000 worth of chemicals a month, has consistently tried to coordinate the scarce compounds and their less critical substitutes with the essentiality of the end product in mind. Shortages of plasticizer, phenol and styrene, for example, are to be attributed to the pressing military need for phthalates, high octane fuel, synthetic rubber and compounds for chemical warfare.

During 1943, the Allocations Office handled 951,000,000 lb. of plastics worth \$362,740,000. Tables showing break-down of these figures were appended to the speech distributed to members.

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Officers and directors of the Society of the Plastics Industry for the year 1944-1945 are as follows:

Chairman of the Board: Ronald Kinnear, president, Niagara Insul-Bake Specialty Co.

President: George K. Scribner, president, Boonton Molding Co.

Vice-president: M. M. Makeever, president, Makalot Corp.

Secretary-treasurer: James B. Neal, Norton Laboratories.

The other directors are: N. A. Backscheider, K. H. Braithwaite, N. O. Broderson, Howard S. Bunn, George H. Clark, E. W. Halbach, W. J. McCortney, Elmer E. Mills, Roy L. Peat, F. G. Schranz and Paul C. Tietz.

# John Wesley Hyatt Award for 1943

THE nation's most distinguished award for achievement in the plastics industry—the John Wesley Hyatt gold medal—was presented to Dr. Stuart D. Douglas, head of Plastics Research, Carbide and Carbon Chemicals Corp., South Charleston, W. Va., at a luncheon held at the Edgewater Beach Hotel, Chicago, Ill., on Thursday, May 11, during the annual conference of the Society of the Plastics Industry. The award is sponsored annually by Hercules Powder Co., Inc., and carries with it a cash gift of \$1000.

Dr. Douglas was selected by the Hyatt award committee to receive the third annual presentation of the medal for his work in the polymerization of vinyl resins. Increased production of vinyl resins, made possible by Dr. Douglas' 17 years of study and development, provided strategic materials in large volume for the wartime manufacture of electrical insulation for wires and cables, coated cloth for military protective coverings, plasticized film for gun covers, rigid sheets for Air Corps instruments and flexible tubing for the aircraft program, among other uses. The use of vinyl resins saved thousands of tons of rubber during 1943.

Dr. Douglas, who was born at Bristol, Vermont, on September 2, 1897, was graduated from Middlebury College with a B.A. degree in 1919. In 1923, he received his M.S. and in 1926 his Ph.D. from the University of Pennsylvania.

Following the completion of his graduate work at this university, Dr. Douglas became associated with Carbide and Carbon Chemicals Corp. in October 1926, and his initial assignment took him to the Mellon Institute where the first experiments with the copolymerization of vinyl chloride with vinyl acetate had been initiated.

After studying the procedure at the Institute, he returned to the South Charleston plant where he began experimenting with the polymerization of vinyl resins.

Because the copolymers of vinyl chloride and vinyl acetate seemed to be more promising for commercial production, that type of resin was selected for intensive investigation. With the help of several assistants Dr. Douglas gave careful study to such challenging factors as catalysts, ratios of vinyl chloride to vinyl acetate, temperature of polymerization, solvents, effect of different metals and the effect of small quantities of impurities in the reactants. A pilot plant was built as soon as experiments proved that continued research on vinyl resins was worth while. In 1931, after 5 years of experimentation, a development plant with a capacity of 50 tons a month was erected. Four years later the first commercial unit was installed, with a capacity of several thousand tons a year.

In the years since 1926, Dr. Douglas and his associates have been granted many patents, all of them covering processes for the refinement and development of "Vinylite" resins. Generally speaking, Dr. Douglas' inventions have



1—Dr. Stuart D. Douglas, winner of the John Wesley Hyatt Award for 1943 for his work in the polymerization of vinyl resins. 2—Detail of one side of medal

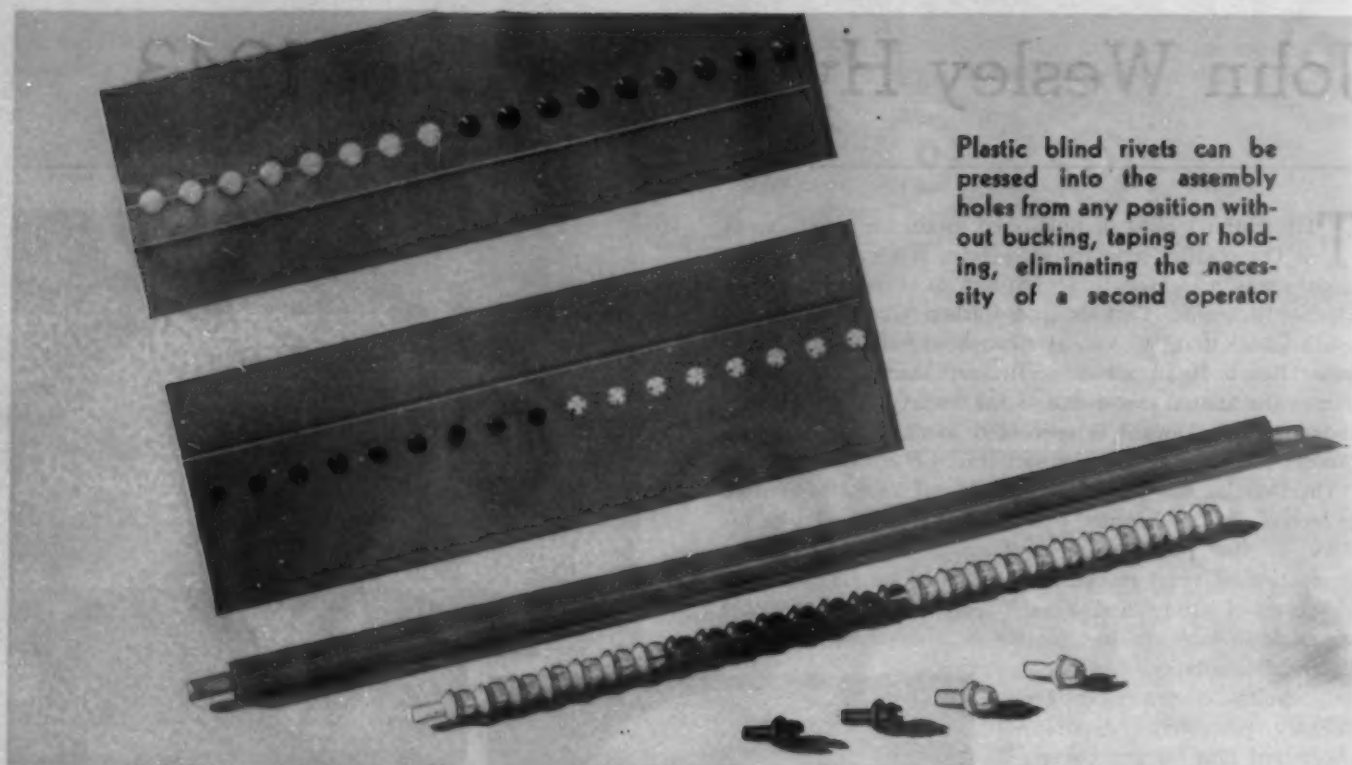


been concerned with controlling the conditions of polymerization so as to yield substantially uniform polymers of high molecular weight.

Many of Dr. Douglas' discoveries, particularly those relating to polymerization and stabilization, are applicable not only to the copolymers of vinyl chloride with vinyl acetate, but also to polyvinyl chloride. It is impossible at this time to disclose the amount of vinyl resin currently used in the nation's war program, nor is it possible to disclose the most important application for "Vinylite" resins, because of military censorship.

Dean Richard F. Bach, of the New York Metropolitan Museum of Art, was toastmaster at the presentation ceremonies. The presentation was made by Dr. Carl Shipp Marvel, professor of Organic Chemistry at the University of Illinois and president-elect of the American Chemical Society. Dr. Douglas accepted the medal and voiced his appreciation.

The members of the award committee who selected Dr. Douglas as the recipient of the Hyatt award were: Dean Richard F. Bach, the Metropolitan Museum of Art; Dr. Lyman J. Briggs, director, National Bureau of Standards; Dr. O. E. Buckley, president, Bell Telephone Laboratories; Dr. Karl T. Compton, president, Massachusetts Institute of Technology; Watson Davis, director, Science Service; Dr. Donald S. Frederick, vice-president, Rohm and Haas Co., Hyatt medalist, 1941; Dr. Thomas Midgley, president, American Chemical Society; George K. Scribner, president, Society of the Plastics Industry; and Frank Shaw, president, Shaw Insulator Co., Hyatt medalist, 1942.



Plastic blind rivets can be pressed into the assembly holes from any position without bucking, taping or holding, eliminating the necessity of a second operator

## One man to a rivet

*It has been the policy of MODERN PLASTICS to delay publication of plastic applications stories until the parts are in actual production. However, this practice has been suspended in the case of the thermoplastic blind rivet described in this article because of the many interesting postwar uses to which this development seems to lend itself.*

**H**AVE you ever watched a riveting operation? The briefest of visits to a riveting department will reveal how numerous and complex are the operations involved in the use of headed pins or bolts as permanent fastenings in metal

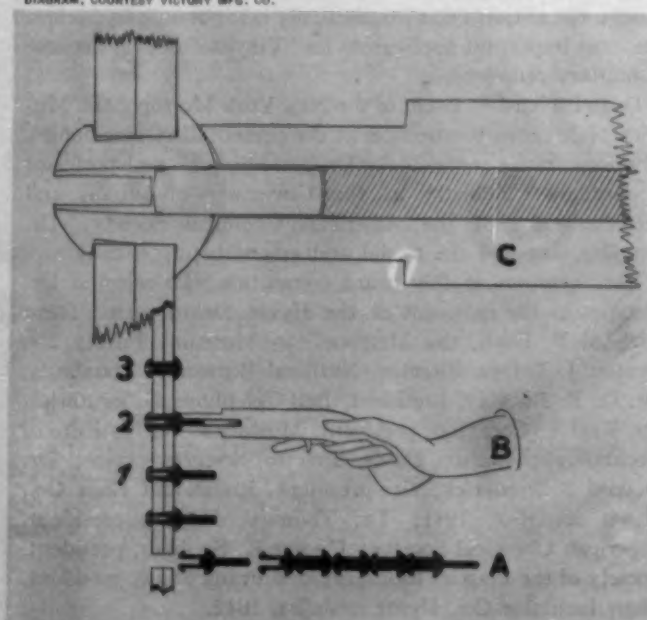
work and in the assembly of many other types of sheet material. And when the time and labor thus expended in one shop is multiplied by the thousands of assembly plants scattered throughout the country, the figures are staggering—in time, labor and costs.

It takes two men to apply a standard rivet—one to handle the rivet gun and one to hold the bucking bar. Frequently, the work of these operators is complicated by the shape and position of the part being assembled. The riveter may be forced to work in a cramped position, further handicapped by the weight and noise of his gun. Again it may be necessary to cut holes in the structural surfaces to permit the second operator to reach in and buck up the rivet. At such times as many as 30 percent of the rivets may drop to the floor, thereby creating a new expense—that of retrieving and sorting the rivets into their multiple classifications.

In contrast, a rivet that can be applied by one person in one operation from one side of a piece of work offers the possibility of a drastic reduction in assembly costs and opens entirely new fields of application. Such a "blind" rivet is snapped into sheets of material from a long column and locked into its hole by a single punch of a light-weight gun. These rivets can be pressed into the assembly holes from any position without bucking, taping or holding.

The principle of the plastic blind rivet is as simple as it is ingenious. As can be seen in Fig. 2 (Please turn to page 172)

DIAGRAM, COURTESY VICTORY MFG. CO.



**2—Legend:** A, rivets assembled for automatic application; B, gun driving wedge into position with one stroke; C, enlargement of "B" showing breakaway; 1, rivet applied creating taper for wedge; 2, wedge forcing rivet against sheets; 3, rivet locked and wedge flush at both ends

# Sculptured restorations

**W**HILE the war and its inevitable backwash of maimed and crippled men has brought prosthesis and its attendant art—sculptured restorations—into sharp emotional focus, the subject has an even more extensive application. It appears that despite continuing safety education and improved safety devices, there will always be victims of industrial and civilian accidents. And a man who loses a section of his hand in a stamping press is as sensitive about the stub as a soldier whose hand has been mutilated by a bullet.

Prosthesis is the technical name for the replacement of missing fingers, ears, arms, hands and feet with mechanical means or aids—principal emphasis being given to replacement. Sculptured restoration on the other hand—a term advanced by Beaver Edwards, Detroit sculptor, for the process he has developed—indicates that the prosthesis shall not only simulate as far as possible the operation of the missing member but shall likewise duplicate the appearance of the missing part. In the opinion of Mr. Edwards, simulation of appearance is as important as mechanical replacement for, if successful, it lessens the feeling of self-consciousness resulting from abbreviations or malformations.

Beaver Edwards' methods are based upon three elements—sculpture, the possibility of replacing the shape of missing features, and the characteristics of plastics by which normal appearance can be simulated, not only in form but in color and texture. Like anyone who is attempting a new application of an old art or technique, Mr. Edwards is handicapped by limitations in existing materials and is constantly experimenting with new combinations in an attempt to devise a formula which will extend the usefulness of his product and shorten the time required for production.

In the case of a maimed or malformed hand—one of the most common problems encountered in restoration work—a plaster of Paris cast is made of the undamaged hand.

After this mold has hardened and been slowly dehydrated, it is heated by degrees to a temperature of about 125° F. The plastic solution which is then poured into this mold has a latex base to which a vulcanizing agent has been added. The toughness of the composition is assured by the addition of a filler—usually French chalk. Just prior to being poured into the mold, the mixture is brought to a temperature of between 125 and 130° F.

It is at this stage of the process that Beaver Edwards has encountered one of the most exacting problems of the entire process. It is essential that the material pour readily and form quickly in the mold, but not too quickly since it is necessary to control the thickness of the resulting cast. As in pottery making, thickness of the cast is determined by the length of time that the mixture is permitted to remain in the mold. Once the plastic solution has been poured into the mold and allowed to set, the surplus is poured off.

Using this replica of the normal hand as the pattern, a model is made of the hand which is being restored to simulate the injured member's appearance prior to injury. Plastiline—a modeling clay which retains its qualities of plasticity unusually well—is used for this work. Upon this clay model depends the effectiveness of the restoration, for it is the basis of a second plaster of Paris mold from which the restoration of the maimed hand is made. After the mold resulting from this plaster cast is slowly dehydrated and brought to a temperature of 125° F., the heated plastic mixture is poured into it. Since the "hand" is destined for daily use, this cast must be thicker than the previous glove-like model. Consequently, the plastic solution is allowed to remain longer in the mold. Here again control of thickness is important. While the "hand" must be thick enough for everyday serviceability, there must be room enough for the installation of such mechanical aids as will assist in the normal functioning of the

- 1—These stumps of fingers provide sufficient mechanical power to enable the patient to have an almost normal hand.  
2—So well has the sculptor been able to duplicate the appearance of the normal hand that restoration is barely noticeable

ALL PHOTOS, COURTESY BEAVER EDWARDS



"hand." These aids vary with each case and are dictated by the degree of damage the member has suffered. Since, at best, mechanical devices are but aids, every effort is made to use to the fullest extent the normal parts of the hand.

When the cast has set, the mold is removed, and the process of restoration advances another step. As it comes from the mold the cast has considerable flash about the palm and the fingers. This flash is removed with scissors, and the seams smoothed by friction. Though the cast is chalk-white it has two important properties—the feel and the resiliency of human skin. Since a restoration must simulate the appearance of human flesh in order to be effective, the plastic hand next is mounted on a sculptor's easel and the process of pigmentation begins. The extent of the mutilation or abbreviation of the hand is indicated on the mold of the hand from which the restorative cast was made and this serves as a guide as the work progresses. There is no such thing as "flesh color," Mr. Edwards insists, unless it be the flaccid coloration on the under side of the wrists. This color is at best a dried-straw yellow, and it is from such a base color applied to the plastic hand that a life-like appearance is created.

Since the capillaries in human hands differ widely, the flesh tints of one person will differ markedly from those of another. This fact necessitates the use of different shades of pink for different "hands." Since the exposure of hands varies with the work done by each individual, the resultant "weathering" also varies and is instantly visible in different skin coloration. This fact makes further color modification most necessary. With this weathering in mind, Mr. Edwards gives careful attention to the normal hand and thoroughly questions the patient as to his manner of living in order to determine what weathering conditions the plastic hand will

encounter. The color hazard of suntan has been met by the judicious use of a temporary pigmentation for the season.

As an indication of the thoroughness Mr. Edwards employs in his restoration work, human hair to match the opposite or normal hand is planted by piercing the surface of the plastic material and cementing the hair root with a plastic cement. A special tool has been developed for this work.

In the case of the restoration of a foot, essentially the same basic routine is employed as that which is followed in the restoration of a hand. However, the application differs slightly in detail. From a plaster cast of the patient's normal foot a mate is modeled in plastilene. This work is done on a small platform, shaped to resemble the arch of the patient's foot when he wore a shoe with a favorite heel. Next a mold is made from this plastilene model. The prosthesis which is cast from this mold resembles a slipper when taken from the negative mold. The "foot" is then filled back to the point of abbreviation with a solid but elastic composition. A steel arch support and a steel sole is incorporated in the prosthesis, and color matching the patient's skin is applied.

Beaver Edwards is proudest of his restorations of major facial sections. One of his best examples of this type of work is a man whose entire lower jaw was removed surgically, leaving him with a horribly malformed face which caused involuntary shudders of repulsion when encountered. For this man Mr. Edwards constructed a new jaw assembly—a dental acrylic being employed as the structural foundation. A contour which was in harmony with the remainder of the patient's features was built up from this basic structure. So exact was the restoration that the man is able to hold a cigarette in his lips, talk—somewhat out of the side of his mouth to be sure—and eat normally. (Please turn to page 156)

3—This malformed foot is normal save for the arrested development of the toes. Despite its abbreviation it contains bone structure important in fashioning a plastic foot. 4—When slipped over the malformed foot the restoration fits snugly around the ankle. A colorless adhesive is applied later to obliterate the line of demarcation

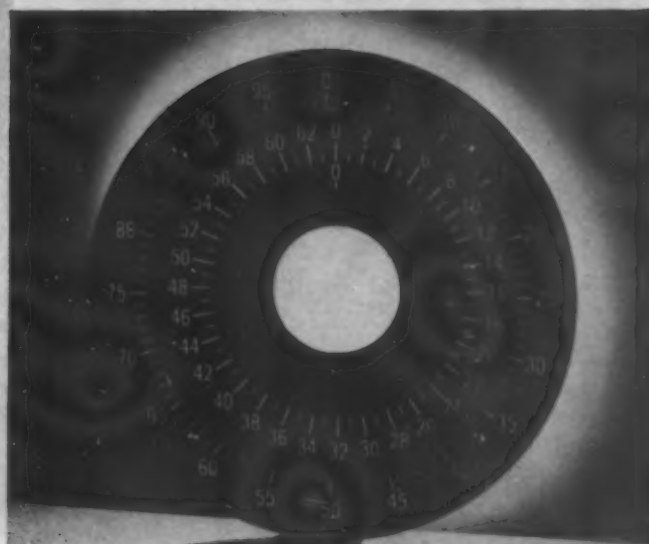
ALL PHOTOS, COURTESY BEAVER EDWARDS



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The azimuth indicator coordinates the target, gun and tank to insure accurate control of the tank gun fire on unseen targets. 1—completed indicator, 2—the diffuser-support plate and inner and outer dial rings, and 3—the assembled dial



## On the mark

ON the other side of the ridge lies the enemy. Here, in the lee of the hill, guns of all calibers are being massed preparatory to softening up the opposing forces—preparatory to an advance. Adding their weight to the concentration of fire power are the turret guns of our new tanks. The role of supporting artillery has been added to the other duties of our armored units as a result of the adoption of azimuth indicators which insure accurate control of tank gun fire when artillery barrages of shell fire are laid down on unseen targets.

In our new tanks, equipped with turrets which swing in 360° arcs, the azimuth indicator is the instrument that coordinates the target, the gun and the tank to an extent that has made our armored vehicles the deadliest in the field. The indicator, mounted on the tank turret, is so geared to a gear rack on the vehicle body that it measures any movement of the turret in respect to the tank in one mil graduations.<sup>1</sup> The gun pointer—one of the two pointers with which this coordinating instrument is equipped—indicates the directional angle of the gun. In laying down a barrage or firing at an unseen target the azimuth indicator measures the calculated angle between a given aiming point which can be seen and the target. For this operation a tank commander gives his tank crew an aiming point upon which they sight their guns. He then gives a deflection angle (in mils) which is the calculated angle between the aiming point and the target designation. The gunner sets this deflection into his azimuth indicator and turns his turret until the instrument indicator reads zero. The gun and turret are then trained in the proper line on the target.

When the demands of war made necessary an accurate

<sup>1</sup> The term "mils" is an Army unit of measure that is used in sighting. One mil is  $\frac{1}{6400}$  of a circle, or one degree equals approximately 18 mils.

method for setting the tank guns on the target, the original plans for the azimuth indicator contemplated a cast-metal dial face with filled-in numerals and calibrations. It was immediately evident that such a unit would be heavy and cumbersome and that the time needed for its production would create a bottleneck in the completion of the entire instrument schedule. With these considerations in mind, plastics were selected for the two dial faces and for the support plate of this indicator unit. Throughout the development of the instrument the Detroit Ordnance Department, the engineering departments of the two primary contractors and the molder worked in the closest cooperation in an effort to get the indicators onto the firing line as quickly as possible. The importance of speed also caused the abandonment of radium painted plastic dials set on metal supporting plates. While the readability of these parts was satisfactory, the process of applying radium paints was too slow and tedious.

It was essential to the successful operation of the instrument that the dial be readable both in full light and in complete blackout. At the same time it was necessary to guard against causing the operator to suffer any effects of night blindness. Drawing upon its experience in the radio and automotive fields and in the production of navigational instruments, the molder selected translucent polyvinyl chloride acetate as the material most suitable for the dial. On the front of the dial the calibrations are in white; on the back the markings are in red. Consequently in daylight the numerals and calibrations are white; in a blackout these markings when lighted for the back show in red—the only color which does not cause temporary night blindness.

Since the design of the azimuth (Please turn to page 164)



CONVOYS STEAM FORWARD SILENTLY—IN COMPLETE darkness. Task forces—with no lights showing—move close to the enemy coast. Navy operations as a whole are conducted with a minimum of light lest one unshuttered beam betray to the enemy the presence of the opposing fleet. But there are occasions when light is absolutely essential to the task in hand. For such moments the Navy has adopted this all-purpose, waterproof plastic flashlight.

This light, which is of the open-end, open-top design, has 3 plastic parts—a cellulose acetate butyrate end cap and body and an acrylic lens cap. The switching mechanism is an integral part of the body and comprises an intermittent

position, a steady position and a lock-off position. The body of this light is molded in a 2-cavity die and designed so that the ribs on the outer surface prevent the flashlight from rolling when placed on a flat surface and make it easier to grip. Both the end cap and the lens cap are molded in 12-cavity dies. In each case a special toggling device is provided so that the threaded cored sections can be quickly removed from the pieces. Molding was selected as the best method for producing the lens cap in order to avoid striation in the material which would cause deflections in the dispersion of the light.

To keep the flashlight waterproof, a small "V" shaped section is molded into the side wall of both the lens cap and the end cap. When the lights are assembled with small rubber washers inserted between the housing and the caps, these "V" shaped projections press down upon the washers. The compression thus obtained and maintained by the thread construction creates a positive seal between the body and the caps, effectively preventing any water seepage. This waterproof design differs from former Navy flashlights of the closed-end type in that these previous models necessitated the use of several screws and a hole in the back end of the flashlight to hold the contact spring.

*Credits—Material: body and end cap, Tenite II; lens cap, Plexiglas. Molded by Reynolds Molded Plastics for Fulton Manufacturing Co. for U. S. Navy*



## PRODUCT

A NEW AWARENESS OF THE PREVALENCE OF respiratory ailments has aroused manufacturers of alleviatory vaporizers to make every effort to continue production despite the diversion to war uses of the metals formerly employed for these instruments. One surgical supply house has utilized plastics for the body, cap, cover and heating shield of its electric steam vaporizer, only the heating element and a porcelain washer being made of a non-synthetic material.

Both the outer shell and the inner or water chamber of this device are molded of a phenol-formaldehyde compound in a 6-cavity semi-positive steam mold with a 5-min. molding cycle. The parts are so designed that sufficient room is left between the two shells to allow the free circulation of air which acts as an insulator against overheating. The cover of the vaporizer is molded of the same plastic material in a 6-cavity die capable of 15 heats per hour. A molded-in cup on the inside of the cover forms the medicine chamber. Steam circulates under the open end of this recess which holds the medicated cotton and absorbs the medicament. It is then discharged into the atmosphere as a medicated vapor.

The heating element at the bottom of the vaporizer is of the carbon electrode type. An electric current passes through the water between the electrodes, heating the water. A shield over the electrodes serves as a non-conductor of electricity and forms a protection against a short circuit. The shield and the electrode nut are molded in 24-cavity dies at 10 heats per hr., of the same thermosetting compound as the other plastic parts.

*Credits—Material: Durez. Inner and outer shells molded by Reynolds Molded Plastics; cover, electrode nut and guard molded by Peerless Molded Plastics, Inc., for the DeVilbiss Co.*

AN ADAPTATION OF THE INVISIBLE "BLACK light" which illuminates instrument dials in the cockpits of bombers and fighter planes without disturbing the night vision of the pilots may in postwar years be used to light up automobile dashboards, the dials of radios and television sets and the regulating devices on kitchen stoves. The new development is made practicable through the use of a plastic filter in combination with a fluorescent lamp and fluorescent-treated plastic dials.

The complete assembly, which comes in two models, consists of a tubular fluorescent lamp and a cellulose acetate butyrate collar and filter. The opaque cylindrical collar is slotted along one side to permit the passage of light. In one type of lamp assembly the collar is first slipped over the fluorescent lamp and the filter inserted between these two parts. For this arrangement the extruded plastic filter is designed to give either white light, ultraviolet light or no light. The desired lighting effect is achieved by the simple expedient of rotating the filter one-half or one degree. For the second model the fluorescent lamp is sealed inside the plastic filter and the collar slipped over this combination unit. In this case, a turn of the collar permits the passage of either black light or no light at all.

It is important to note that the cellulose acetate butyrate material used for both the collar and filter is specially condi-



tioned to achieve improved dimensional and heat stability. The plastic filter is treated with a pigment that filters out most of the white light and permits the passage of black light. These invisible rays activate the fluorescent markings on the dials which have been cut from polystyrene sheet. The lamp unit may be inserted in front of the dial, as in the case of dashboard indicators, or behind the dial faces as in radios and television sets. The use of plastic dials eliminates the expensive polishing and etching operations which are associated with the production of glass indicators.

*Credits—Material: filter and collar, Tenite II; dials, Lustron. Manufactured by Lion Mfg. Corp. and developed by J. M. Gordon*

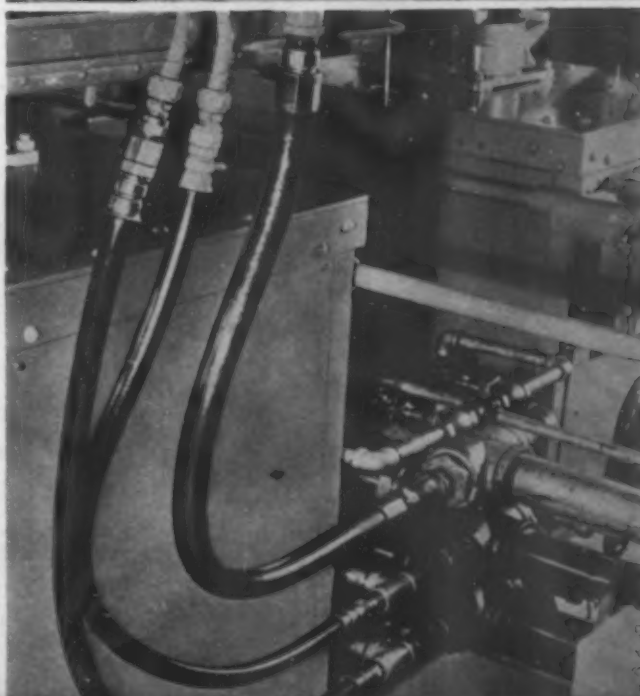
## DEVELOPMENT

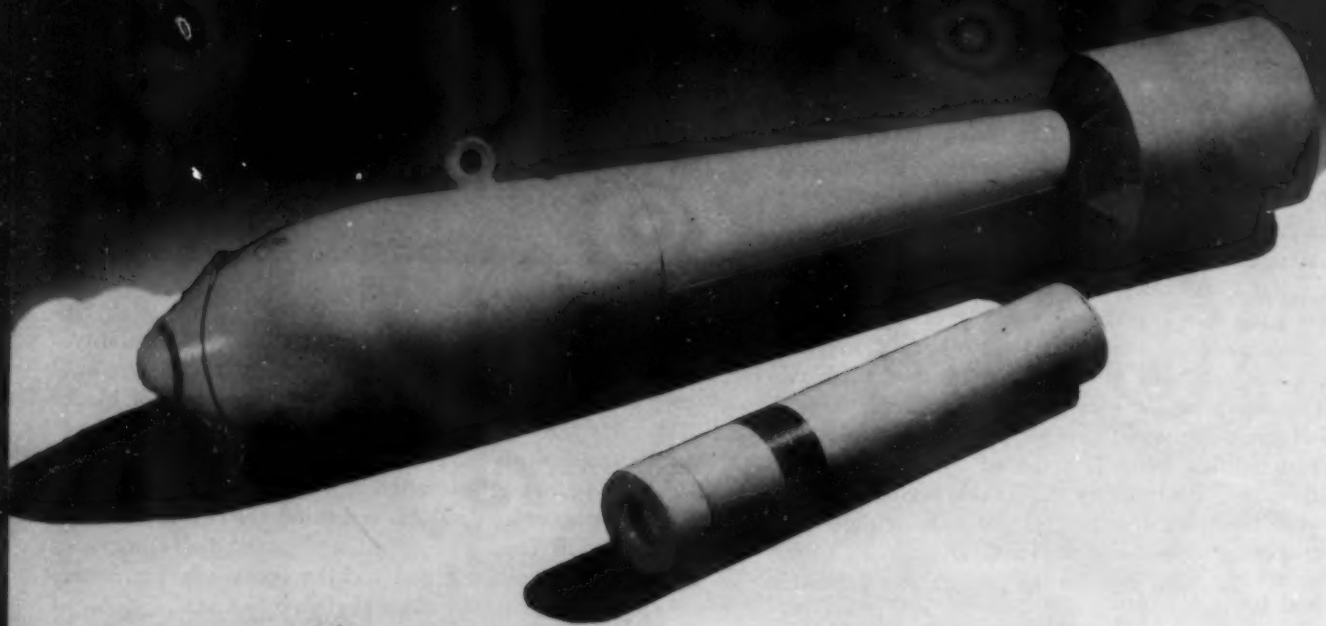
FLYING AND BOMBING INSTRUMENTS MUST operate with the greatest precision if our planes are to fly directly to a predetermined target, release their bombs and return unerringly to hidden bases. To insure the unvarying performance of the navigational instruments that make these flights possible, each device before it is accepted by the Army must undergo tests during which it is subjected to more extreme conditions than would ordinarily be encountered in actual flight.

But these tests, which must be conducted on a round-the-clock basis and without deviation from a predetermined standard, throw a tremendous strain upon the testing equipment. For example, until a few years ago hose used for all connections on test stands enjoyed a very short life and frequently failed. Experience indicated that hose with a core of compar was not only impermeable to oil but in some cases was so wear-resistant that a single line served for 5 years without showing signs of bulging and without loss of tensile strength or flexibility.

Even when subjected to hammer pressure of from 150 to 200 lb., short flexible lines of compar hose were found to retain their tensile strength. This type of hose also withstood the constant coupling and uncoupling attendant upon the testing methods and the action of hydraulic fluid which tends to permeate the wall of tubes and undermine the outer layer. Before compar was adopted, minute flecks of material were frequently removed from the inside of the hose by the high velocity of the oil flow—particles that subsequently lodged in the sensitive testing mechanism. The use of compar solved this problem.

*Credits—Material: Resistoflex compar, for hose used by Sperry Gyroscope Co., Inc.*





## Target practice for a blitz

**T**HE Duke of Wellington is supposed to have made the observation that the battle of Waterloo was won on the playing fields of Eton. Historians, particularly those who specialize in studying the part aviation has played in this war, will probably paraphrase the Duke and observe that the air blitz of Berlin was accomplished in the bombing schools of the R.C.A.F.

It is a far cry from the British Commonwealth Air Training centers in Canada, where British, Australian, New Zealand, Canadian and other Empire air recruits learn the rudiments of air warfare, to blockbusting air attacks over Berlin and other German industrial targets. But the heroes of last night's raid were the graduates of last year's crop of pilots, navigators and bomb aimers. Those who practiced last year with the 11½-lb. R.C.A.F. training bomb are out to-night bound for their targets with 4-ton bombs.

In Canada the destructive science of aerial bombardment is taught by practice bombing, using a miniature 11½-lb. practice bomb (Fig. 1) which contains a cartridge with a cellulose acetate head and tail cap. Bomb aimers in the Royal Canadian Air Force undergo a rigid training period which includes high level, low level and dive bombing tests. The bomb these airmen use is designed to produce a smoke explosive by day and flash detonation at night, when it hits the target area. This enables the bomb aimer to make any necessary corrections in his bomb sight and air position after observing his first hit. After a series of practice hits, each student is carefully rated by actual bombing scores obtained by observers stationed in protected areas bordering the target.

The R.C.A.F. practice bomb is a cartridge type which was developed about two years ago to replace the conventional acid-type bomb. Unlike the latter, it employs an explosive-filled, smoke-producing cartridge which makes possible a close simulation of actual battle conditions. The adoption of the cartridge-type bomb also enabled the R.C.A.F. to conserve strategic metal and chemical materials, and to pro-

duce the large number of bombs required at a considerable saving and without sacrificing any efficiency in the training of its air crews.

The practice bomb is not a toy. It must be handled with all the precautions and care that the ground crew would give to a blockbuster. The cartridge is filled with an explosive capable of doing considerable damage if carelessly handled. The same safety measures and safety devices required on combat types are required in storing and loading the practice bomb. Likewise the bomb's design simulates that of bombs used in actual combat.

In addition to the all-important cartridge, the bomb assembly is composed of a nose piece and a tail unit. When the bomb is assembled prior to loading on the training bomber (Fig. 1), the first step is the fuzing of the cartridge by the insertion of a detonator in the cartridge head. The live cartridge is then fitted into the bomb nose. Finally the tail cone and the nose of the bomb are screwed together. At the tip of the bomb nose is the striker head—the first point of contact—which is linked directly to the detonator by a detonating pin. This pin is held in place by three safety devices: 1) the safety pin which is removed when the bomb is loaded on the bomb rack, 2) the safety plunger which is held in position by the bomb carrier crutch and ejected by the safety plunger spring when the bomb is released, and 3) a fine shearing wire which continues to hold the striker in position until the bomb hits the target area. The shearing wire then shatters, allowing the striker to contact the detonator.

In a sensitive mechanism such as this, it was absolutely essential that allowance be made for an easy but snug fit of the detonator in the cartridge head, and the cartridge plus detonator into the bomb. A wooden cartridge was first developed but proved entirely unsatisfactory due to the uncontrollable expansion of the wood under atmospheric changes. This characteristic of wood caused such a dangerous binding of the sensitive detonators that the R.C.A.F. was

forced to abandon wood entirely. It was then apparent that a material had to be adopted which, besides having a very small expansion and contraction coefficient under temperature and atmospheric extremes, must also be capable of being worked to the required tolerances. It was at this point that the practical use of molded plastic parts became apparent.

In the preliminary experiments with plastic cartridge heads a solid plastic head was molded. Difficulties were immediately encountered in holding the necessary dimensions, due to the eccentricities in the amount of contraction of the plastic in the cooling cycle after molding. The resulting product involved a high percentage of rejects after inspection gaging operations. After continued experimentation the molders hit upon the idea of molding a hollow, thin-walled cartridge head of cellulose acetate wherein the contraction on cooling could be controlled to a tolerance of  $\pm 0.005$ . The number of rejects dropped immediately and useful mass production of these parts began.

The cartridge is a long cylindrical kraft paper tube, closed at one end by a cellulose acetate cartridge head, and at the other by a cellulose acetate cap (Fig. 2). The assembly is made more rigid by a compact sealing of the plastic ends into the kraft tube, allowance having been made in the design of the plastic parts to guarantee a snug fit. The paper and plastic surfaces are bonded together by a cement made from a solution of cellulose acetate dissolved in acetone. This adhesive forms a seal between the case and the plastic which holds even after the cartridge is blasted.

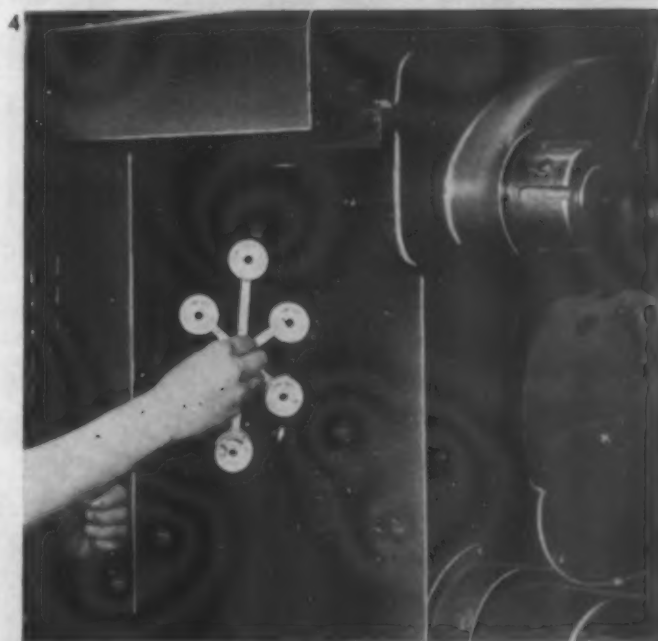
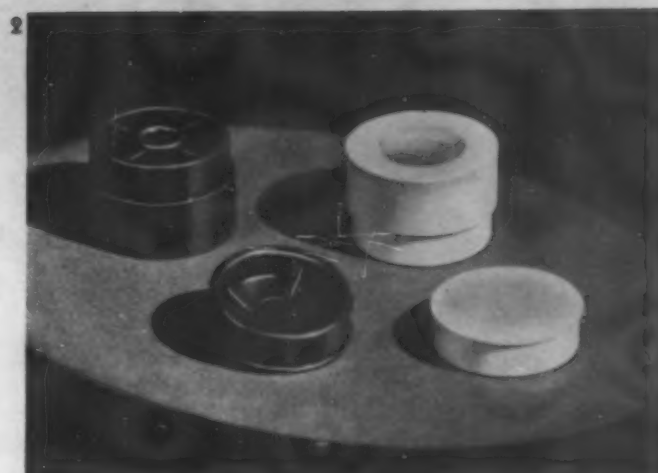
The cellulose acetate cartridge head is molded in an injection-molding machine in shots of six (Fig. 4) and the bottom cap is molded in a shot of eight. Careful molding is important, and each cartridge head is precision gaged three times before it is accepted (Fig. 3). The cavity for the detonator, which is a brass-headed fuze, must meet requirements of  $\pm 0.005$  to insure accurate firing. After the molder has gaged the cartridge head, it is again tested by R.C.A.F. inspectors, and the explosives company that fills the cartridges. The dimensioning of the plastic parts to fit the sleeve of the cartridge kraft container is equally important.

A close liaison was established between the molders and the cartridge manufacturers in developing a product which would be practicable for both. After the preliminary experiments it was soon found that the use of plastics for this sensitive task had skilfully surmounted the problem of obtaining dimensional tolerances required to build successfully a low-cost practice bomb without the use of costlier metals.

Once again the adaptability of plastics has proved its usefulness in Canadian war production. Canadian-trained bomb aimers go overseas soundly schooled in the bigger and more important task of levelling the German war machine and its production centers. In this small but infinitely tangible way plastics are making one more important contribution to the Allies' air supremacy and ultimate victory.

*Credits—Molded by M. Wintrob & Sons, Ltd., and Reliable Plastics, Ltd., for Royal Canadian Air Force*

1—A miniature 11 $\frac{1}{2}$ -lb. cartridge bomb and an assembled cartridge prior to its insertion in the missile. 2—Inside and outside views of the cellulose acetate head and cap used on the practice bomb. 3—Each head is precision gaged 3 times before it is finally accepted. 4—The heads are injection molded in 6-cavity, the cap in 8-cavity dies. 5—A diagram showing the relation of the plastic cap and head to the contents of the cartridge





1

**1** This saran cap assembly for a gas purifier bottle has been found to function more effectively and to possess greater durability than the regulation glass cap. Injection molded in a single-cavity die by Elmer E. Mills Corp. for Fisher Scientific Co., the cap has a bullet-like projection in the center of the top through which a hole is drilled at either end to permit gas to enter and leave the bottle. A threaded insert that fits into the projection from the underside, connects the top with a glass rod leading into the jar



**2** To save weight and time and to increase production, 5 parts of this cockpit lamp are injection molded of Tenite II by Standard Molding Corp. for Standard Aircraft Products, Inc. Reading from left to right the plastic pieces are: the filter housing, the filter, the lamp body housing, the switch button and the knob. The complete assembly can be seen at the top



2

**3** To guarantee perfect performance Army planes must be tested constantly. This aircraft instrument tester, housed in a Durez case and having a turntable of the same phenolic molding compound, functions with highest accuracy even under climatic extremes. The McCaskey Register Co., American Aircraft Associates, Plastic Molding Corp. and Durez Plastics and Chemicals, Inc., pooled their experience to produce this new testing equipment which replaces the aluminum and zinc units. Since the over-all dimensions of both halves of the housing are identical, one mold was ingeniously designed to produce both sections. This was accomplished by having 2 sets of plugs and insert guides which can be interchanged to form the different halves



3

**4** Farmers and truck gardeners have a guaranteed protection from predatory livestock in an electrical barbed-wire fence controller encased in shatterproof Tenite. This transparent housing, molded by Eclipse Moulded Products Co. for Northern Signal



4

Co., Inc., is impervious to temperature changes, and allows immediate observation of the motor and the neon light which indicates the amount of charge present in the fence

**5** Payday in the Army is as much of an event as it ever was in civilian life. To make certain that every G.I. Joe receives his hard-earned dollars, heavy transparent Lumarith envelopes are employed by the Quartermaster's Corps to house individual pay records and protect them from wear, tear and perspiration. Measuring 3 x 5 in., these durable envelopes are shipped to the various General Depots where they form part of the permanent record of every soldier

**6** Entirely new fields in plastic fabrication are being opened up with the newly developed Panelyte Grade 906, a fully cured laminated thermosetting sheet which can be stamped, bent and drawn in a process similar to that used in metal stamping. This material can be processed by a highly simplified method in compound curvatures and fairly sharp bends

**7** Electronics—that newest of sciences—has encouraged a host of new uses for plastics, among which is an external connection board for sub-panel and chassis construction, composed of 1 to 10 feed-through terminals mounted in general-purpose Bakelite. This terminal block is molded by the Midwest Molding and Mfg. Co. for Curtis Development and Mfg. Co.

**8** This pelorus diagram-type drift sight is used for sighting purposes on land. Similar to a mariner's compass in appearance, it is without magnetic needles and has two sight vanes by which bearings are taken. Calibrations are screened on the laminated Bakelite base and protected by several coats of varnish. The pointer is injection molded of Lucite in a single-cavity die. The instrument is molded by Cruver Mfg. Co. for U.S. Coast Guard

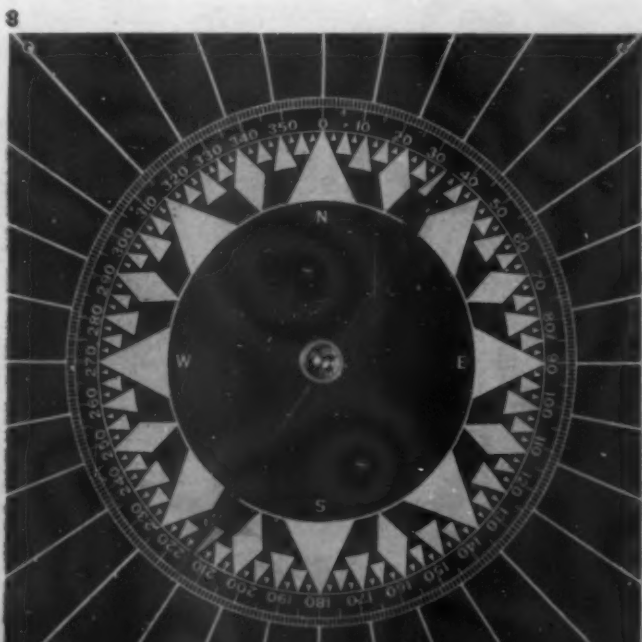
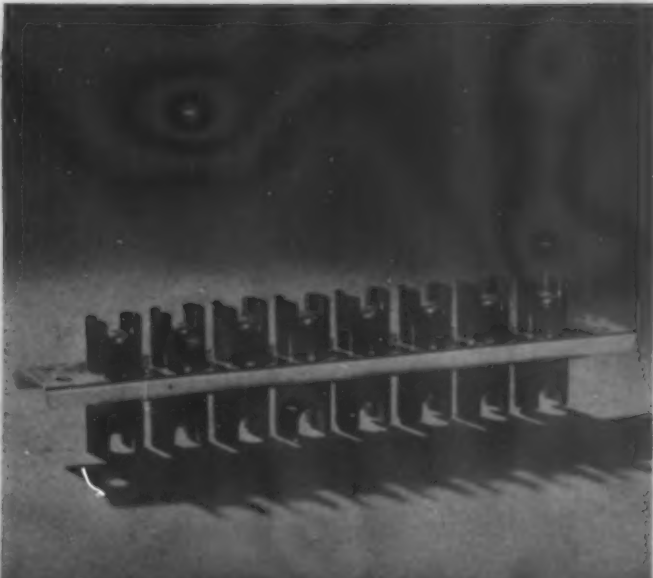
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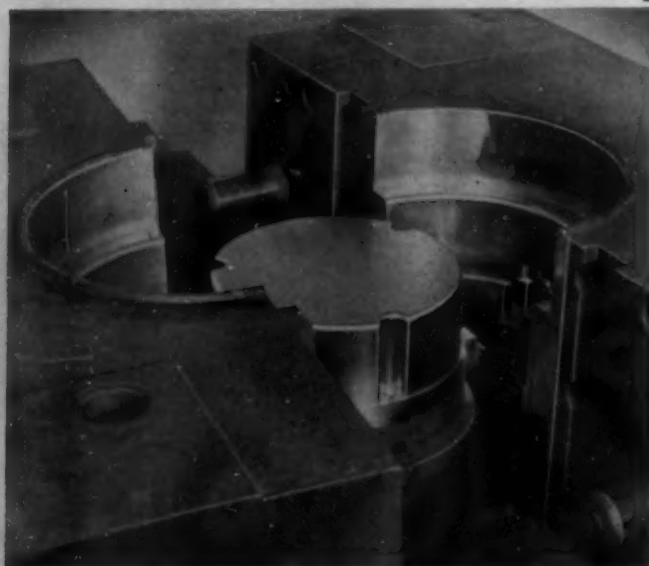


**F**ROM time immemorial marine clocks set in neat cases of highly polished brass have graced the walls of ships' engine rooms. More recently these clocks have found their way into defense factories where their dependable performance has made them invaluable. As our war production program gained momentum, clock manufacturers were faced with such rigid material restrictions as to prohibit their use of metal for clock housings. To stop making these clocks because of this limitation was unthinkable. Accurate timing is not only vital to the proper functioning of a ship's crew but is indispensable in the operation of the highly geared and intricate machinery of a defense plant. As in the case of so many other industries faced with similar problems, clock manufacturers turned to plastics for a solution. And plastics provided the answer. Experimenting with a phenolic resin, molders produced a clock housing the equal of the brass case in strength and durability, and comparing favorably with the metal in lightness, cost of manufacture and appearance.

The housing and cover of the clock which is made in two sizes—6-in. and 8-in.—are compression molded of both high and medium impact material. The choice of material depends upon the application. For example, because of its exposure to greater extremes of temperature and the vagaries

PHOTO, COURTESY GENERAL ELECTRIC CO.

2



## Up to the minute

*A new phenolic housing and cover for mariners' clocks has enabled the manufacturer to continue the production of these highly essential timepieces. 2—The split-cavity die used in the molding of the clock case is shown with the splits in an open position. 3—The clock case requires comparatively few finishing operations*

of ocean storms, a case to be used on a ship would be molded of high-impact material. A case to be used in a factory, where temperature is fairly constant and normal atmospheric conditions prevail, would be molded of medium-impact material. Powder is used in the molding of high-impact compounds while preforms suffice for the shaping of those of medium impact. When preforms are used the weight of each pellet is approximately 15 oz., and only one is necessary for each part of the case. Curing time for the molds is 6 minutes.

The single cavity mold used for the original clock was equipped with a removable side plug mounted in a ring. In order to eject the molded part from this mold, it was necessary to knock out the ring, removable plug and molded part at the same time. The removable plug and molded part were then knocked from the ring. As the final disassembly operation, the plug was removed from the hinge lugs. With all these loose parts in the mold, many sections of the case had heavy fins and parting lines. Great difficulty was experienced in properly finishing the case at these points, and for this reason the appearance of the clock case was not satisfactory to the clock company.

To overcome these difficulties a new mold was designed. This split mold was for a press (Please turn to page 172)

3



### Injection mold design—Part I

by ISLYN THOMAS†

THE purpose of this article is to bring together the customer, the sales engineer and the mold designer so that they may reach a better understanding of one another's problems. To achieve this end, some of the basic fundamental rules and principles necessary for the successful operation of an injection mold are reviewed on the following pages.

#### Facts to consider before starting mold design

Molds are frequently designed without sufficient knowledge of the part and its use. As a result, the finished molded pieces sometimes fall short of the customer's expectations. In numerous cases of this nature, many of the objections could have been overcome if all the necessary information regarding the piece had been presented to the mold designer.

**Know the facts**—In order to secure as much information as possible for the mold designer, the sales engineer should keep in mind the following simple rules when he discusses with the customer the part to be molded.

1. Can the part be molded? Sometimes, in the general excitement of securing an order, the sales engineer fails to realize that the part has been changed and, in its revised form, cannot be molded. This may be due to some added feature such as an undercut.

2. Can the part be simplified? At times, slight changes

in the design of the part to be molded simplify the mold, and reduce the cost of the mold and the molded parts without affecting the ultimate use of the article.

3. What is the material? Definite information should be obtained as to the particular plastic that is desired since materials have different shrinkage characteristics which directly affect the mold size. In some instances, this variation necessitates the use of different types of gates, runners and heating and cooling channels in order to obtain maximum efficiency.

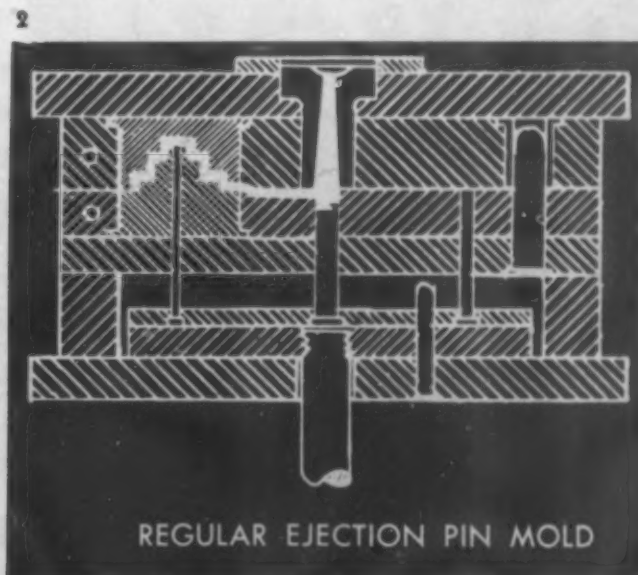
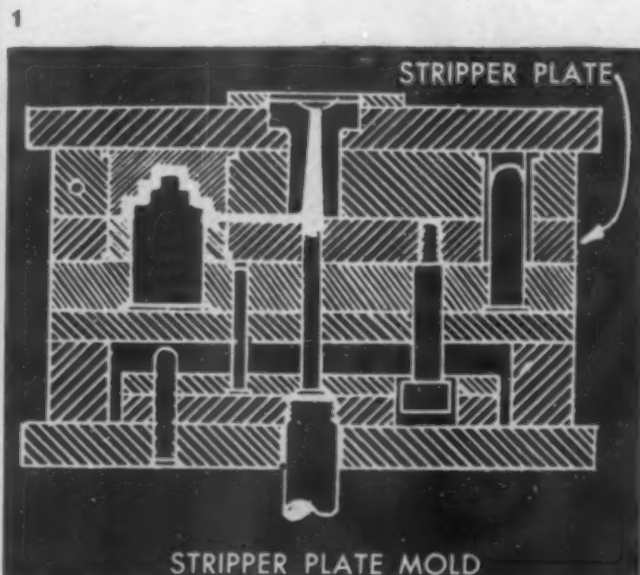
4. What tolerances are specified? Serious consideration should be given to the tolerances that are requested since variations in dimensions are dependent upon toolroom tolerance in mold construction, wearing of the mold, variation in shrinkage in different batches of the same material, and the molding technique.

5. How is the part to be used? Information on this point will indicate whether the parting edge or draft will interfere with the operation of the article.

6. What is the quality of the article? This rule covers such questions as: Is the molded part to be used as an integral part of an expensive unit? Can it be seen? Is appearance important?

7. How many parts are to be molded? The question of quantity is naturally important. It would not be economical to build a large, strong production mold if only a few hun-

1—A cross-section of a stripper plate mold. 2—Cross-section of a regular ejection pin mold



\* Reg. U. S. Pat. Office

dred or possibly a thousand pieces were required. In such instances, an inexpensive single-cavity mold would probably be sufficient.

8. What is the capacity of the machine? It is important that the approximate weight of the article be checked to determine whether the injection machine is large enough to handle the piece. In many cases molds have been made too large for the machines for which they were designed.

**Number of cavities**—The number of cavities in the mold are dependent upon the following factors:

1. Quantity of molded parts desired.
2. Maximum injection capacity of the molding machine.
3. Total area of the molded pieces, runners and gates.
4. The clamping pressure exerted to hold the mold closed during the injection cycle.

In order to arrive at the desired number of cavities, each of the above factors must be taken into consideration and carefully analyzed.

**Type of mold**—Injection molds are especially suitable for intricate shapes with completely automatic cores and ejector mechanisms. Before molds are designed with threaded core plugs, considerable thought should be given to the disadvantages and advantages of completely automatic unscrewing cores as compared to molds with loose threaded core plates. It should be borne in mind that complicated molds are generally more expensive. Compared to simple, fool-proof molds, the upkeep cost on these intricate molds is greater and breakdowns more probable. Too often a stripper-type mold (Fig. 1) has been built when a less expensive, easier operating ejection-pin type mold (Fig. 2) would have been just as efficient—even more efficient in some instances.

**Where to gate**—Generally, the final mass of material that enters the mold is the hottest. Because of this fact, the gates should be located as near the appearance surface as possible, provided this arrangement takes advantage of the

best flow conditions. This placement of the gates helps prevent weld marks which are, essentially, the result of incomplete blending or welding of the material. The finishing operation is a second factor that influences the placement of the gate. The gate should be placed to permit simple and inexpensive trimming as long as such positioning does not interfere with the flow of material.

**Selection of steel**—The following 5 factors should be considered in the selection of the steel used in the construction of the mold:

1. Size and finish required in the molded part.
2. Number of pieces to be manufactured.
3. Pressures necessary in forming the molded pieces.
4. Corrosion and erosion characteristics of the plastic material.
5. Cost of building the mold. Why should an expensive tool-steel mold be built for 100 pieces when, very possibly, a less expensive machine steel mold would prove satisfactory for that quantity of molded parts?

After the steel has been selected, care must be taken to ensure that the metal possesses the following properties:

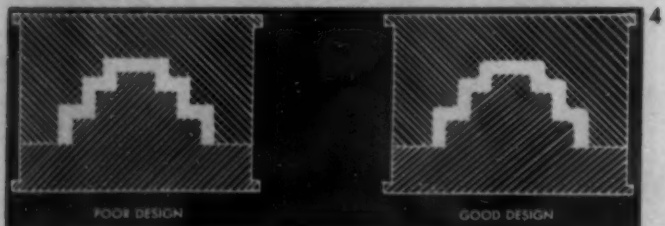
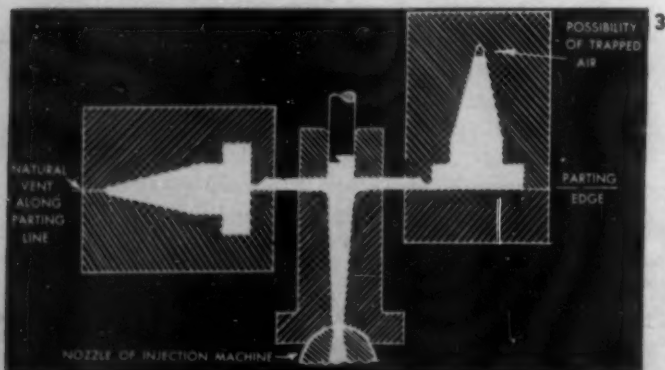
1. Cleanliness.
2. Ease of fabrication.
3. Strength to resist deformation.
4. Wear resistance.

Since both tool steels and machine steels have certain advantages and disadvantages, considerable thought should be given to the selection of the correct type of metal.

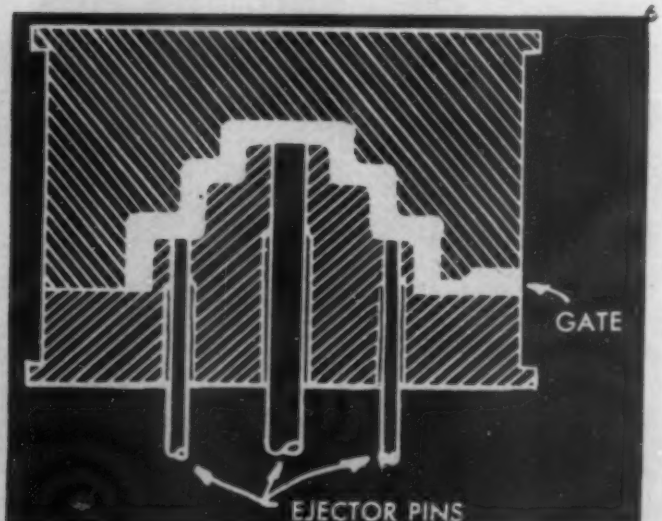
### Design of mold parts

In starting the design of a mold, it is best to draw a side view of the part to be molded, determine the parting edge and then design the mold parts.

**Parting edge**—Although the parting edge is a very important detail, it is not generally given the consideration it de-



3—This blueprint shows how one article could be molded in at least two different ways. The parting edge helps to determine what mold design should be used so that natural vents will help prevent burns and weld lines. 4—Examples of good and poor cavity design. Sharp corners weaken the mold, set up strains and retard the flow of material. 5—Cross section of straight and Z-type pins. 6—Drawing showing possible position of ejector pins which are used to remove an article from force plug



serves. In addition to having a direct bearing on the cost of the mold and the moldings, the parting edge helps to determine what molding technique should be used so that natural vents will help to prevent burns and weld lines. Figure 3 illustrates how one particular article could be molded in at least two different ways. In this instance, molding on the flat would eliminate the possibility of burns, weld lines and incomplete moldings caused by trapped air.

**Cavities**—In designing the cavities around the article, care should be taken to eliminate all sharp corners even if it is necessary to contact the customer in order to make these changes. Sharp corners weaken the mold, set up strains in molded pieces and retard the flow of material (Fig. 4).

**Ejector pins**—The ejector pin is used to remove the article from the face or back cavity (Fig. 6). When there is any doubt as to the number of ejector pins that are necessary, it is best to go the extreme—even to the point of placing the pins under runners or gates. This procedure will help to keep the articles from sticking in the mold—a condition that is detrimental to the uniform cycles which are so necessary in injection molding. Ejector pins—or push pins as they are sometimes called—can be used successfully as vents. If the pin marks are objectionable, they can be camouflaged with trade marks or with mold and cavity numbers.

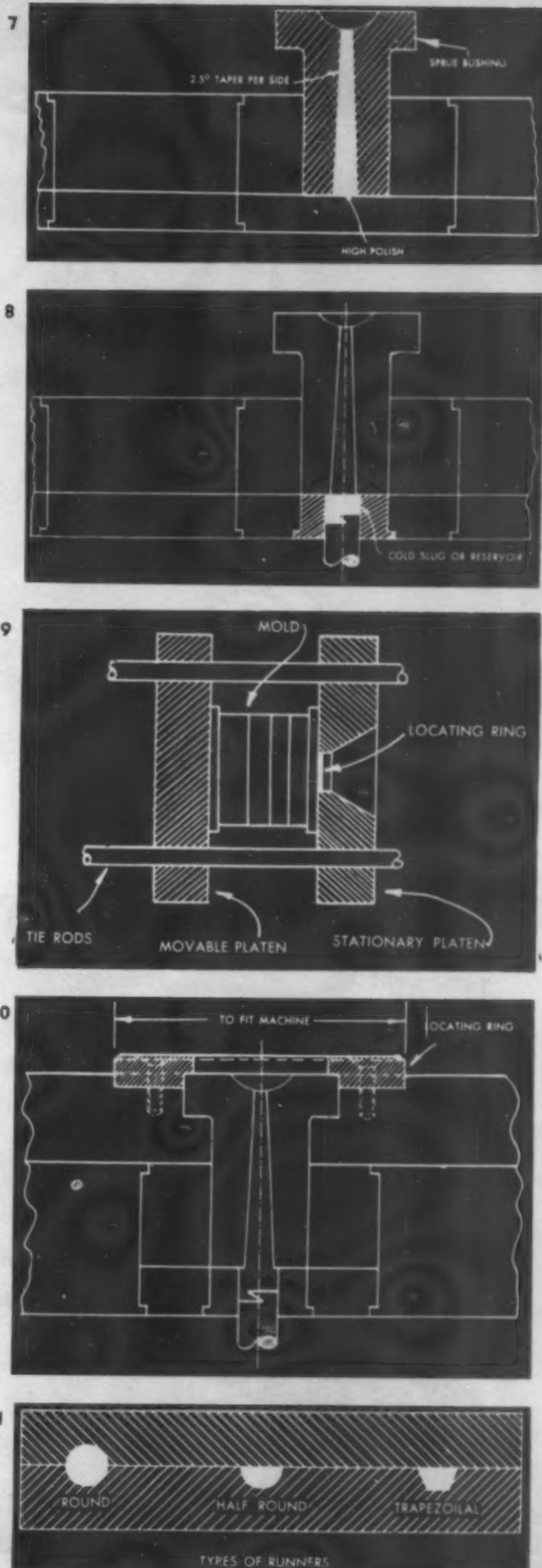
**Sprue bushing**—The hardened steel sprue bushing is located in the stationary part of the mold, and the polished hole running through the bushing is the medium by which the plastic material enters the closed mold from the injection machine (Fig. 7). The radius provides a seat for the nozzle of the plasticizing chamber. The diameter of the hole at the radius should be larger than the diameter of the hole in the nozzle—a taper of  $2.5^\circ$  per side has generally been found satisfactory for the average mold.

**Cold slug or reservoir**—An important but sometimes disregarded element of injection mold design is the reservoir immediately beyond the end of the injection sprue which receives the first cold slug of material as it comes from the nozzle. This reservoir also helps the flow of material to the cavities by providing greater clearance at this  $90^\circ$  turn (Fig. 8). If the reservoir were omitted the cold slug of material would enter the cavity and possibly cause smudge or flow marks in the molded article.

**Sprue lock pin**—The purpose of the Z-type sprue lock pin is to pull the molded sprue from the sprue bushing by means of a hook. The Z-pin is fastened to the ejector mechanism of the mold and ejects the cold slug from the reservoir when the mold opens at the end of the molding cycle. Two popular types of pins (Fig. 5) are the Z-pin and the straight pin for tapered or undercut reservoirs.

**Locating ring**—The main purpose of the locating ring is to line up the mold in the press so that the sprue bushing is directly in line with the nozzle of the machine (Fig. 9). Sometimes the locating ring can be used to anchor the sprue bushing in the mold (Fig. 10). (Please turn to page 164)

7—This drawing shows the position of the sprue bushing. 8—The reservoir immediately beyond the end of the injection sprue receives the first cold slug of material as it comes from the nozzle and helps the flow of plastic to the cavities. 9—The locating ring lines up the mold in the press so that the sprue bushing is directly in line with the nozzle. 10—This drawing shows how the locating ring is employed at times to anchor the sprue bushing in the mold. 11—Either a round, half round or trapezoidal type of runner may be used



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Plaskon Resin Glue has played an important part in making possible this departure

*A detailed view of the glued-up arch I-beams with laminated cap strips and plywood web. Construction principles similar to these, and also employing Plaskon Resin Glue, now are successfully used in the design and assembly of wooden aircraft.*



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The construction shown here uses all-wood prefabricated arches, built up in I-beam sections with laminated cap strips and a plywood web . . . the entire assembly being *permanently* bonded with Plaskon Resin Glue. Designed to carry a live load of 40 pounds per square foot of roof area, tests on these Plaskon-glued arches prove they can carry 250% in excess of this requirement. Plaskon-bonded plywood is used for exterior sheathing.

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# Progress in heatronic molding

by V. E. MEHARG and A. P. MAZZUCHELLI\*

The general technique of heatronic molding is discussed and new applications and industrial installations considered

**A**BOUT one year ago, the unusual advantages of high-frequency heating of molding materials by the heatronic process were described in this publication.<sup>1</sup> Developments since that time have been many and, generally speaking, have fully confirmed the early expectations for this new discovery. Furthermore, extended use of the process by many molders has emphasized new advantages and has intensified interest in other plastics applications for this type of heating.

The difficulty of obtaining high-frequency generators for work which did not involve critical war production placed a limitation on the application of this process. Fortunately, however, enough molders were engaged in furnishing vital parts to warrant a priority sufficient to obtain units, and these are giving a fair idea of the problems and benefits which the molder can expect. However, there is some evidence that the process is not being used to its full advantage and that full knowledge of the technique of heatronic molding is lacking. In this article, some of the various problems encountered will be discussed in order to increase the general understanding of the process.

Essentially, heatronic molding involves the heating of a thermosetting molding material uniformly throughout its mass to about molding temperature in a high-frequency electrostatic field; then transferring the hot and soft preform to the heated die without loss of plasticity; and finally, molding the material in the usual manner. It is by this simple sequence of operations that the numerous advantages of this process have been obtained. However, the attainment of optimum conditions which will produce the best result depends on many factors and bears clarification.

## Heating rate

For example, in order to heat a preform of thermosetting material to molding temperature, and to transfer it to the die without loss of flow, there is a definite limitation in the time available, depending not on the size of the preform but on the temperature selected, the type of material and mold, and the particular benefits desired. Experimentally, it has been

found necessary to heat the preform to molding temperature within 45–60 sec. and to transfer it to the die and complete flow within an additional 10 to 30 seconds. If longer periods are required, it will be necessary to use a material of slower hardening properties or to heat to a less critical temperature.

It is obvious that the main objective of this process is to eliminate the limitation of heat conductivity of the material during molding and that, therefore, the curing time in the mold will depend on the preform temperature obtained prior to molding. It therefore becomes essential to have the preform temperature as high as possible if the molding cycle is to be reduced to a minimum. This applies particularly to compression molding. In transfer molding it has been found that somewhat lower temperatures (25 to 50° F. less than those used in compression molding) are preferable, since the frictional heat developed in flowing the material through the orifice and runners of the mold tends to increase the temperature and sometimes preclude the material.

Preform temperature will not only affect flow and speed of cure but also the amount of volatiles lost by evaporation. This may be shown by the effect on the electrical properties (Fig. 2) of a 4 1/4-in. diameter by 1/8-in. disk molded from a 2-in. diameter preform weighing 45 gr. which was heated to various temperatures in 60 sec. by high frequency. In order to approach electrical properties equivalent to those obtained by oven-preheating, it is necessary to use the slowest permissible heating rate without loss of flow and the proper electrode set-up, so that the volatiles will have the greatest opportunity to escape. The loss of volatiles is also a close function of heating rate and preform size.

## Transfer time

The relationship between preform temperature and available transfer time for phenolic molding material is shown graphically in Fig. 3 and follows the general equation.

$$T = K \log ct$$

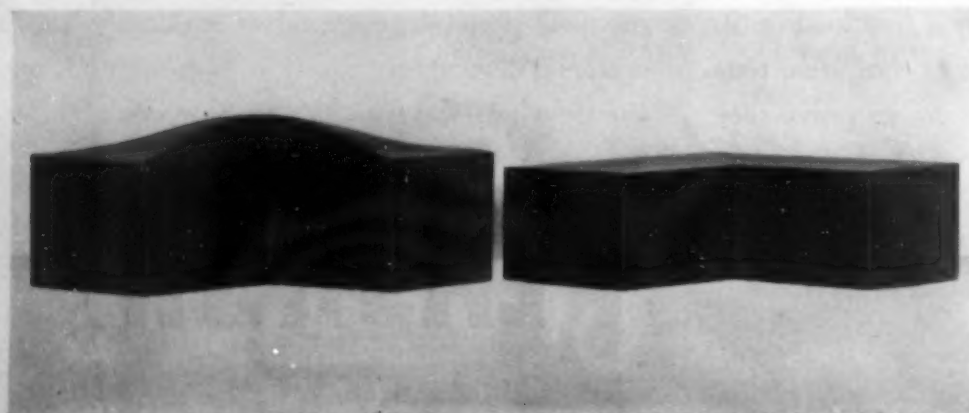
where

$T$  = temperature in ° F.

$t$  = maximum permissible holding time

$K$  and  $c$  = constants

This shows the increasingly critical nature of the thermo-



1—At left is standard molded block 6 x 6 x 2.25 in. which was cured 1 hr. at 320°F., 2100 p.s.i., and discharged hot. A woodflour-filled phenolic material was used. At right is a heatronic molded block 6 x 6 x 2 in. which was cured 5 min. at 320°F., 2100 p.s.i. The same material was used in molding this block as was employed in the first

\* Research and Development Laboratories, Bakelite Corp.  
<sup>1</sup> "Heatronic Molding," by V. E. Meharg, MODERN PLASTICS 20, 87–90 (Mar. 1943).

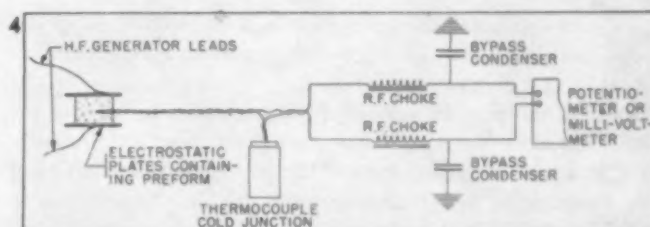
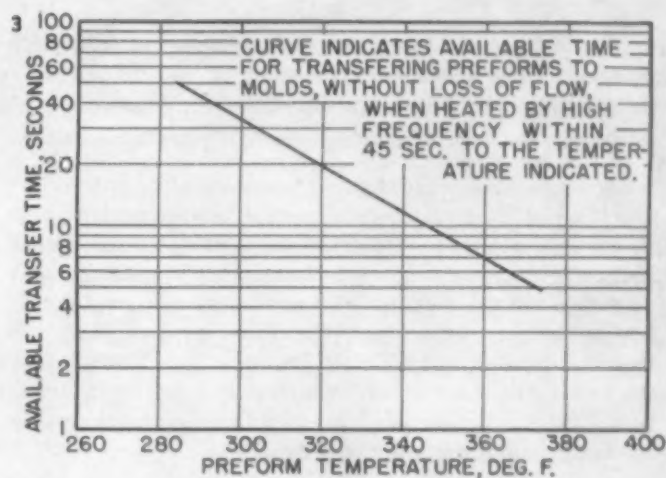
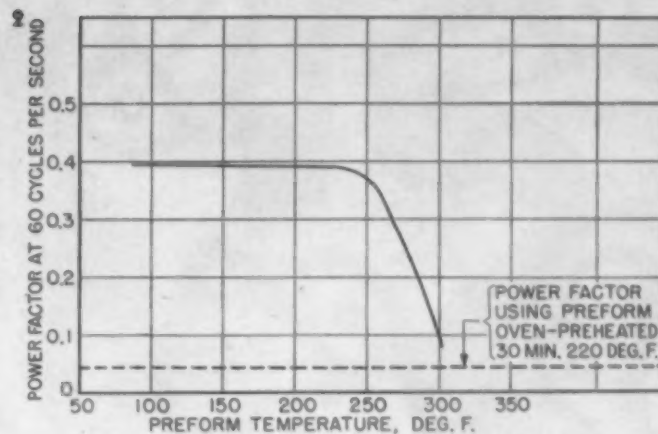
setting reaction as the temperature is raised, and it serves to demonstrate the great difference between ordinary oven-preheating and heatronic molding. Whereas an oven-preheated preform is relatively stable and does not lose flow appreciably over an extended period of time, a heatronically heated preform is comparatively unstable. It must be heated in the high-frequency field for only a limited time to a definite temperature. If heated for any longer time or if held at molding temperature, it will become hard and cured before molding. Thus, there is danger of mold damage unless one adheres closely to the cycles described. Most commercial high-frequency generators are provided with suitable timers which shut off the equipment automatically to prevent this overheating. However, for very high preform temperatures, it is best that all the operations be automatic if full over-all advantages are to be realized.

### Temperature measurement

One of the primary difficulties in evaluating heating rate and the temperature to which a preform has been heated is the lack of adequate and satisfactory means for temperature measurement. In the laboratory, a thermocouple has been used successfully with a filter circuit (Fig. 4) protecting the galvanometer of the potentiometer from radio-frequency currents while thermocouple readings are being made in the high-frequency field. Accurate usage, however, requires 1) symmetrical positioning of the junction in the load between the electrodes, 2) use of electrodes of the same or only slightly larger area than the specimen being heated, 3) an electrically balanced circuit (thus, this technique cannot be used with a grounded electrode) and 4) a heating load that is a reasonably good insulator. A thermocouple may be permanently installed in the grounded electrode itself when such a set-up is used, but this will only indicate surface temperature at the electrode. These limitations will restrict the general use of thermocouples by the molders.

The measurement of temperature by the melting point of a smear chalked on the surface of a preform with a "Tempilstik" or brushed on with "Tempilac" appears to be reasonably accurate and useful up to 300° F. Above 300° F. the surface cooling effects resulting from evaporation of moisture and loss of volatiles increase the deviation between internal and surface temperature beyond the degree of usefulness. Thus, a preform may be 375° F. and precured in the center, whereas the surface temperature may only indicate 325° F. However, intelligent use of these indicators should prove of considerable value in actual practice.

The most common and generally used indication that a high-frequency heated-preform is near molding temperature is the smoking point. This smoking point usually corresponds to 275-300° F. and indicates that the material is about



2—Effect of preform temperature on power factor of disk heatronic molded of woodflour-filled phenolic material. A 2-in. in diameter preform (45 gr.) was heated for 60 sec. by high frequency to temperatures indicated. 3—Allowable holding time at various preform temperatures for cellulose-filled phenolic material. 4—Temperature measurement in a high-frequency field using a thermocouple. Useful only with set-up comprising 2 high potential electrodes. 5—Experimental electrode set-up and glass retainer for heating powdered plastic materials by high frequency. Capacity is about 1500 gr. of woodflour filled material or 800 gr. of fabric-filled phenolic powder



PHOTO, COURTESY BILEY CO.

6



7

6—At the right is a handle for a glass coffee maker which was molded of a phenolic material. The irregular-shaped flat preform (left) was heatronic-heated to 300°F. in 30 sec. and heatronic-molded in 45 sec. at 320°F. Standard molding required 2 minutes. 7—Fabric-filled phenolic powder which was high-frequency heated to 300°F. is ready for transfer to the mold in an atmospherically preformed state. Polystyrene clamps are used to hold screen electrodes in place

ready for molding. However, it is only applicable to cellulose-filled molding materials of normal volatile content, and it cannot be applied to very dry or very wet materials. Other indirect methods involve the change in plate voltage and amperage and particularly the quantitative drop in grid current as the charge is heated. Generally, it is most desirable to determine experimentally the heating time which will give the best results for the particular material and set-up being used. Once this time has been established, there is usually no difficulty in duplicating results.

### Uniformity of heating

The fast rate of heating required for most heatronic applications imposes a problem in uniformity more severe than for other high-frequency applications. The erratic results obtained in molding in a majority of instances are due to insufficient uniformity in temperature throughout the preforms and to a lack of appreciation of the necessity for maintaining the minimum of temperature variation within the preforms if good results are to be expected. This variation may be due to many factors but principally to the use of poor preforms or improper electrode set-ups.

Although preforms may be unlimited in size and contour, their height should be no greater than their diameter or width and preferably  $\frac{1}{2}$  as high to preclude field distortion. The preforms should be flat, and they should be uniform in thickness and density; weak preforms with crumbled edges should be avoided. More than one preform may be heated at one time, but in certain cases it may be difficult to bring the top electrode in equal contact with all the preforms. In this case it is generally desirable to insert an air gap (no greater than  $\frac{1}{4}$  in.) between the preforms and the upper electrode. This will not only facilitate handling but will also compensate for any minor variations in heating rate which may be caused by the slight differences in height normally obtained with standard preforming machines. Multiple preform heating may be accomplished in this manner using a conventional loading board. However, it will be necessary to make the retainer of a good low-loss insulator, such as a ceramic or laminated material, which, preferably, is arc-resistant. The customary designs may be followed, except that the retainer wall should be no more than half as high as the preforms to be heated and the cavities should be large enough to allow for swelling of the preforms when they are heated.

The electrodes providing the high-frequency field should be designed carefully. The simplest and most effective technique is to place the preform between two flat metal electrodes, only slightly larger than the preform itself, and in direct contact with them. Care should be taken that the electrodes are the same distance apart and maintained in position by a weight or by spring pressure so that they will not be moved when the preform swells and distorts on heating. Obviously, this set-up is not too practical in production, especially when more than one preform is heated. It is preferable to install permanent electrodes so that a  $\frac{1}{8}$ - $\frac{1}{4}$ -in. air gap is present between the preform and top electrode.

Non-uniformity of heating may be caused by use of large and heavy plates having a relatively high heat capacity with respect to the load. Such electrodes should be warmed or replaced, where possible, with flattened screen electrodes. These may be made from 10-mesh screen (0.041-in. wire diameter) bound by a copper tube to provide a smooth edge. The screen absorbs practically no heat from the hot preform and eliminates condensation of moisture on preforms and electrodes. Such condensation is conducive to arcing and to surface blistering and poor appearance of the molded piece. The ultimate in refinement involves placing the whole electrode assembly in a suitably warmed and ventilated chamber.

Commercial high-frequency generators may be operated with both electrodes at high potential and with one "hot" and one grounded electrode. Tuning and rate of heating are generally satisfactory for both methods, but use of the two "hot" electrodes has been found in the laboratory to give greater uniformity of preform temperature. However, by properly shaping (dog-earing) overhanging flaps or by making the high potential electrode very large with respect to the load and grounded plate, the grounded plate electrode system may be made to heat uniformly.

Dielectric materials whose shapes are not regular may be heated uniformly by properly shaping the electrodes so that the voltage gradient is the same throughout the mass. Figure 8 shows the distribution of temperature when a cylindrical preform is heated from the side with flat electrodes; Fig. 9 shows improperly curved electrodes and properly shaped electrodes for this same preform as calculated or determined by trial and error.

It is obvious that in the molding of very large pieces, especially from impact materials, the use of preforms would be

a serious limitation, except in cases where a sufficient number of small preforms could be combined to give the required weight. However, it has been found that by use of a suitable glass or ceramic retainer, powder may be heated with sufficient uniformity for most applications, provided the apparent density is kept fairly constant throughout the mass. Cellulose-filled and fabric-filled molding materials with apparent densities of 0.50 and 0.25, respectively, will heat equally satisfactorily, requiring only slight additional machine capacity over that required for preforms. When heated in this manner to molding temperature, the materials atmospherically preform and cohere sufficiently so that they may often be handled without breaking up. It must be mentioned, however, that it is generally more difficult to get perfect uniformity of heating of powder than of preforms because of variable density, increased radiation losses, and the greater cooling effect of volatiles. Nevertheless, practically equivalent reduction in cure and pressure has been obtained.

## Molding

After a preform has been heated uniformly and transferred to the die without loss of flow, the customary procedure of molding may be followed, certain minor precautions being taken to insure maximum reduction in pressure and cure.

It is very important that the mold be closed and flow completed as rapidly as possible, except where localized burning due to gas or air entrapment is encountered. In certain cases this rapid closing may require installation of larger hydraulic lines to slow moving presses. Normal molding

temperatures are satisfactory for compression molding, although the use of slightly higher temperatures will assist in the full development of gloss at very short cures and preclude surface blisters or pimples. In fact, in the molding of phenolic closures and urea molding material, the heatronic process permits use of mold temperatures above decomposition temperature for these materials because of the short time that the material is in the die. In transfer molding, the pot and orifice should be kept cooler than the mold, which should be well vented. Breathing the mold is desirable in some cases but it must be done very quickly after closing the mold.

Wherever possible, fully positive or semi-positive dies should be used. Flash molds are satisfactory where flow is in the direct line of the movement of the force, but certain dies, such as one for a washing-machine agitator, which contain recessed areas and which hold the heated charge near the flash line until the mold is closed, may not permit full reduction in pressure. In such cases, specially designed dies may ultimately become necessary to take into consideration the hydraulic-type fluid flow obtained by the heatronic process.

Cure time is usually determined by the length of time required to produce a blister-free piece in the mold. In heatronic molding this cure time may be reduced from two- to tenfold, and still produce moldings which are equivalent or better, in acetone extractives, mechanical properties, etc. However, if blistering is used as the sole criterion, the molded pieces may exhibit somewhat more flexibility and swelling at the lowest cures. The over-all reduction in density is

8—This graph shows voltage and temperature gradient across a cylindrical shaped preform heated from the side with flat high-frequency electrodes. 9—Uniformly heated cylindrical preforms are shown here as they appear from the side. A indicates the incorrect shape while B shows the correct form. 10—Variations in loss factor of preformed materials with frequency at room temperature. Curve A represents comparison between a plain phenolic resin preform containing an insignificant amount of moisture and standard woodflour-filled phenolic preforms with varying moisture contents. Curve B demonstrates the loss factor of three plain woodflour preforms which have moisture contents ranging from approximately two to eight percent

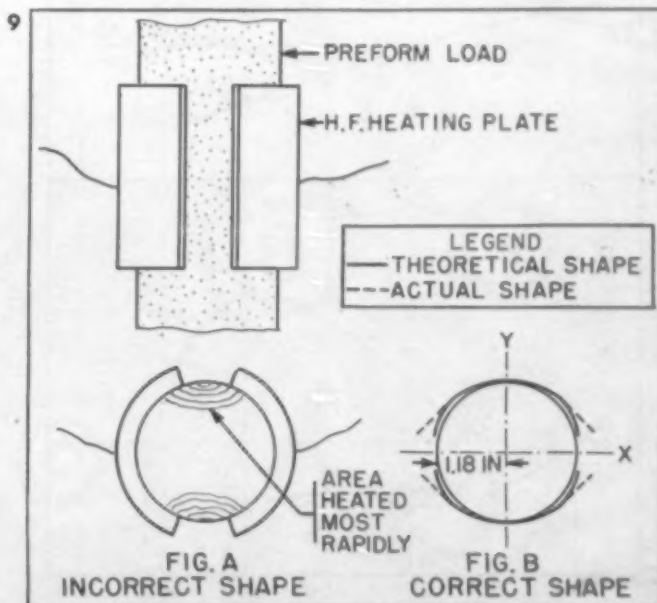
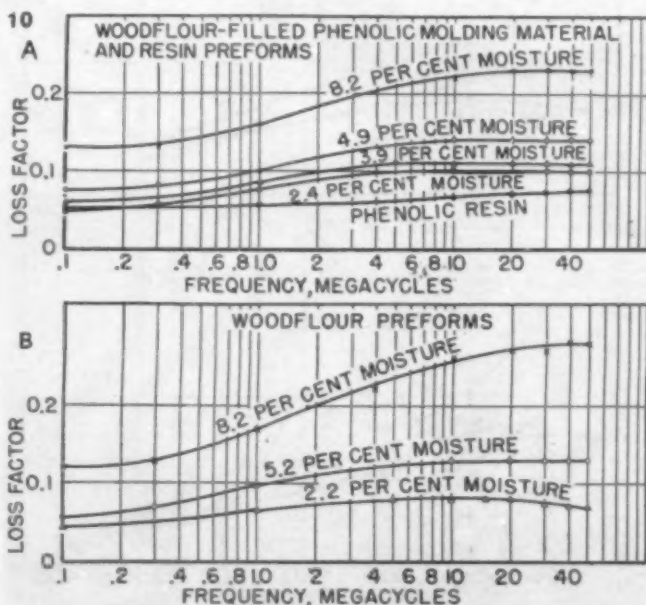
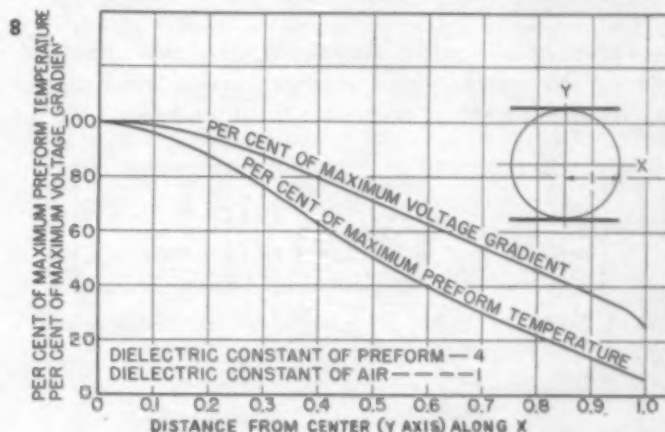


TABLE I.—EFFECT OF FREQUENCY ON VOLTAGE AT ELECTRODES

Material	Heating rate	Voltage across electrodes— volts/cm.		
		30 mega- cycles	10 mega- cycles	2 mega- cycles
Woodflour-filled phenolic	5.0 watts/cc.	1368	2365	5,290
Mica-filled phenolic	5.0 watts/cc.	2930	5080	11,350
Mica-filled phenolic	3.2 watts/cc.	2350	4070	9,100

only about 0.5 percent, but this may be precluded by increasing the cure slightly, which will also improve surface gloss and appearance simultaneously.

### Frequency

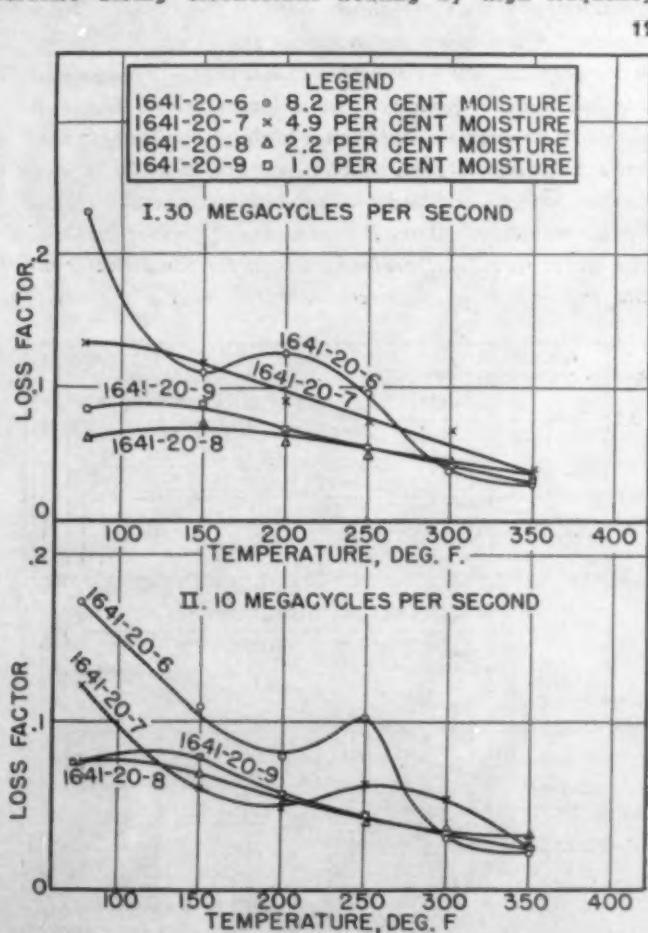
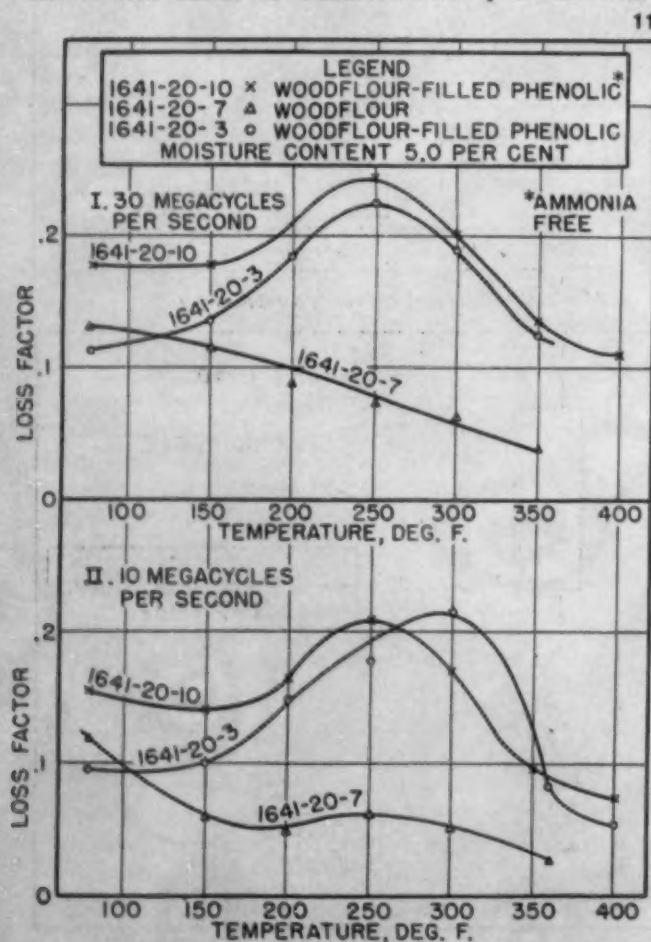
Reports have been received from the industry that for regular molding materials a sharp peak in the loss factor existed at about 28 megacycles. Since this would have considerable effect on the frequency selected for commercial units, a careful check was made of the change in loss factor with frequency for a cellulose-filled molding material and its principal components in the preformed state. Figure 10 shows the relationship between resin, woodflour and molding material at different moisture contents from 1 to 50 megacycles and the absence of any significant variations in loss factor over the present commercial range.

Measurements of loss factor were also made on the same

preforms while they were being heated to molding temperature at about the rate normally used for heatronic molding. These data (Figs. 11, 12 and 13), indicate that loss factor is principally a function of temperature (as it affects viscosity and chemical structure), moisture content and physical state, the effect of frequency being comparatively negligible over the range studied. It may be noticed that the woodflour decreases from 0.12 to 0.05 in loss factor when heated to 250–300° F., whereas the molding material increases correspondingly from 0.10 to 0.15–0.20. This would indicate that the loss factor of the resin component rises sharply when heated as its viscosity decreases, and then diminishes rapidly as it cures and becomes hard. There is increasing evidence that the separate ingredients of a molding material absorb high-frequency energy and heat up at a variable rate in an electrostatic field of constant frequency and intensity, depending on specific heat and loss factor. The uniformity of heating normally obtained, then, is a function of the physical state of the material and thermal conduction between the various components.

Although loss factor does not vary appreciably with frequency, other factors limit selection for practical use. Arcing and flashovers, caused by excessive voltages at the electrodes, are a serious difficulty and limit the rate of heating when too low a frequency is used. This is especially true when it is desired to heat a material of fairly good electrical properties. Table I shows the relationship between frequency and voltage for several materials in which the electrodes are in direct contact. Use of a large air gap also causes flashovers, and it is to be discouraged, except in special cases where a preform swells

11—These graphs give a comparison of the variation in loss factor with temperature for several preformed materials having the same moisture content when heated by high frequency. 12—A graphic comparison of variation of loss factor of woodflour-filled preforms with temperature during electrostatic heating by high frequency



erratically on heating and happens to come into contact with the top electrode. This condition, which often produces an arc caused by the concentration of energy at this point, may be prevented by increasing the air gap sufficiently to preclude contact. Use of highly polished electrodes free from sharp edges and elimination of condensed moisture by use of screen electrodes and of ionized air by proper ventilation will also minimize arcing.

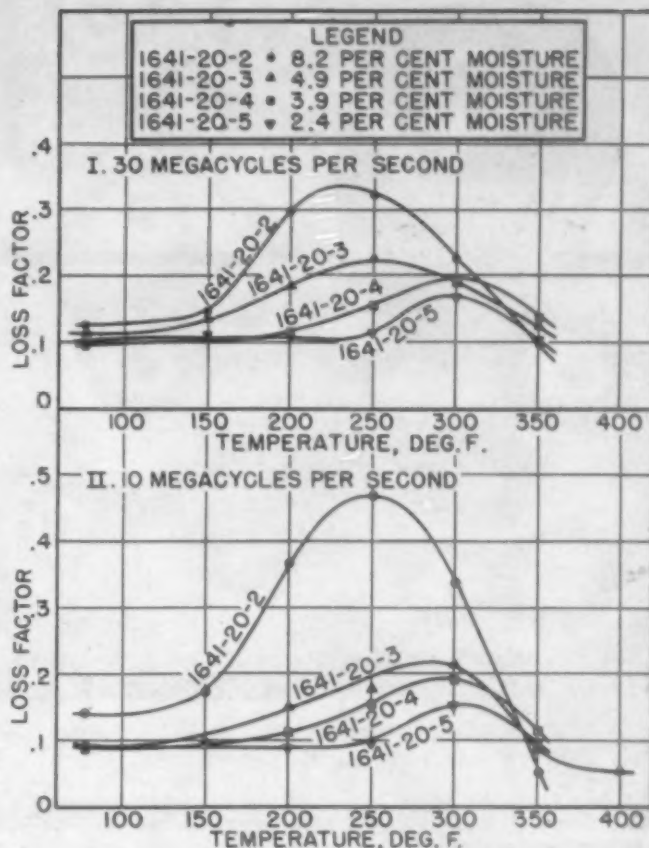
### Materials

The heatronic process is applicable to the molding of a variety of plastic materials with minor modifications. Thus, thermoplastics may be molded with considerable advantage by compression. Molding cycles for thin sections are reduced to those normally obtained for thermosetting materials, and the use of standard compression dies with good control of pressure makes the process especially adaptable to large pieces. Similarly, application to injection molding permits molding of large pieces from more heat-sensitive materials with closer control of finished properties. Brakelining materials have been heated and molded satisfactorily from preforms and powder. With certain precautions, particularly as to rate of heating, partially conducting materials and materials containing conducting particles have also been heated and molded. Besides black and brown phenolic materials, colored and mottled materials will mold satisfactorily and give good molded appearance. Generally speaking, the slower curing materials are preferable for thick sections and moldings requiring exceptional flow. Urea and melamine materials are somewhat more critical than phenolics but have been molded by this process with considerable success.

### Equipment

The principal requirement in the purchase of a high-frequency generator is that sufficient capacity be obtained to heat the plastic under consideration within the required time, as previously discussed. For heatronic molding 2.0 to 2.5 kw. output capacity per lb. of material is adequate. However, it is generally advisable to overestimate capacity since more stable operation and longer tube life are obtained when the machines are used carefully. Furthermore, it may be only a short time before the machine is changed to a different job requiring a greater load than was originally intended.

Commercial generators are becoming more simplified and automatic, and serious consideration is being given to the combination of press and heater into a single unit. Some installations involve a central high-frequency heater which provides a number of adjoining presses with hot preforms ready for molding by proper cycling. Greater care is being taken to protect the operators from any accidental burning



13—These graphs show the variation of loss factor of woodflour-filled phenolic preforms with changes in temperature during electrostatic heating by high frequency

by the installation of safety devices, and considerable effort is being made to ground and shield the equipment properly to minimize the effects of undesirable broadcasting and outside interference.

### Advantages

To review briefly, the use of the heatronic process shows the following principal advantages in molding thermosetting materials:

- Faster rate of cure and hence higher production.
- Reduced pressure necessary for molding, or
- Greatly improved flow at normal pressures.

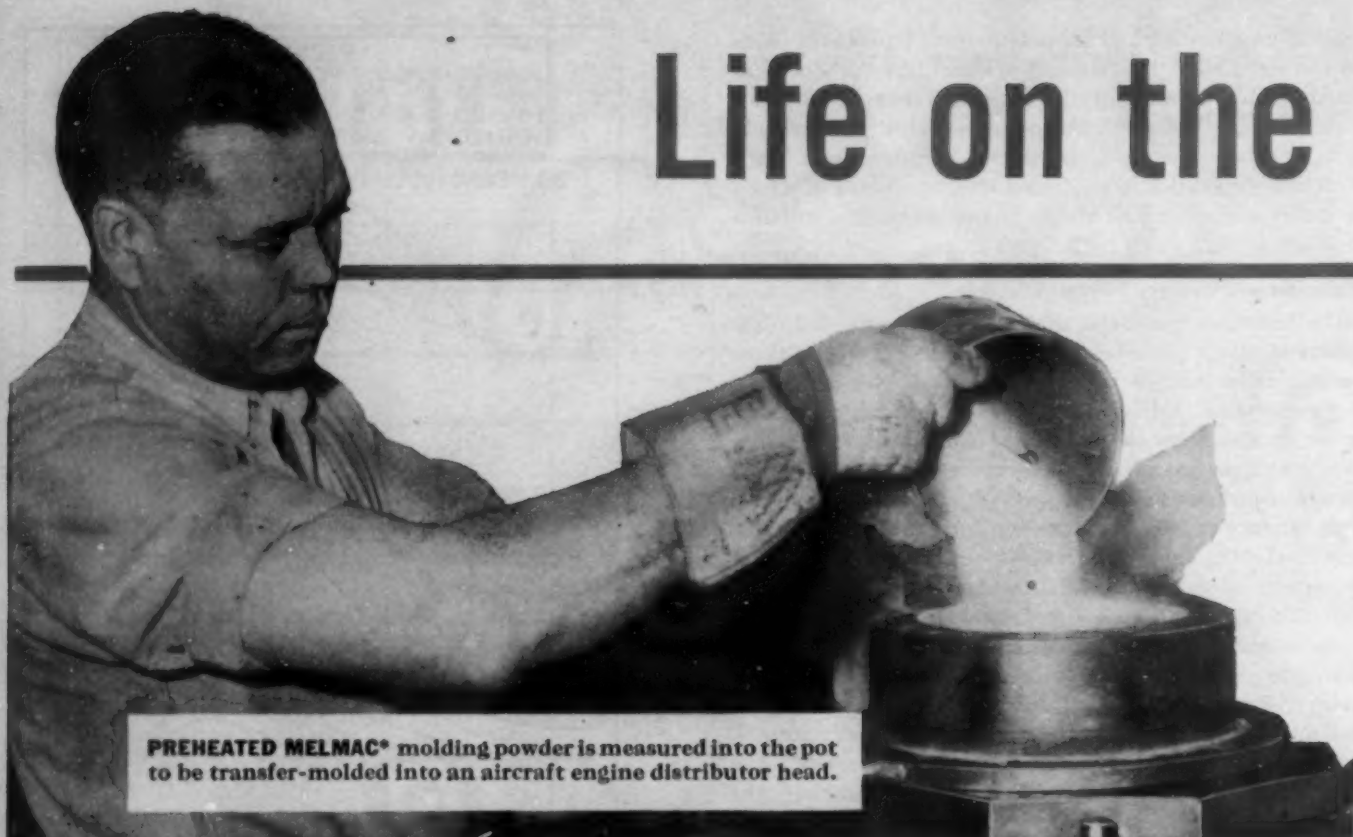
These advantages show up quite markedly in a variety of practical applications. Size of moldings and thickness of section no longer present any limita- (Please turn to page 160)

TABLE II.—PROPERTIES OF HEATRONIC-MOLDED THICK BLOCKS (6 IN. BY 6 IN. BY 2 1/4 IN.)

Property	Woodflour-filled phenolic material		Fabric-filled phenolic material	
	Standard cured 2 1/2 hr. discharged cold. 2100 p.s.i.	Heatronic cured 5 min. discharged hot. 2100 p.s.i.	Standard cured 2 1/2 hr. discharged cold. 2100 p.s.i.	Heatronic cured 5 min. discharged hot. 2100 p.s.i.
Over-all density	1.335	1.329	1.396	1.384
Swelling, percent	+0.62	+0.99	+0.46	+2.09
Acetone extractives, percent	1.49	1.39	0.63	1.54
Average tensile, p.s.i.	4200 ± 988	5440 ± 548		
Average deviation in tensile, percent	±23	±10		
Elongation, percent	0.416 ± 0.087	0.581 ± 0.066		
Average deviation in elongation, percent	±21	±11.4		
*Average impact, ft.-lb. energy to break	0.160 ± 0.012	0.171 ± 0.014		
Average deviation in impact, percent	±7.5	±8.2		

\* Special machined specimens.

# Life on the



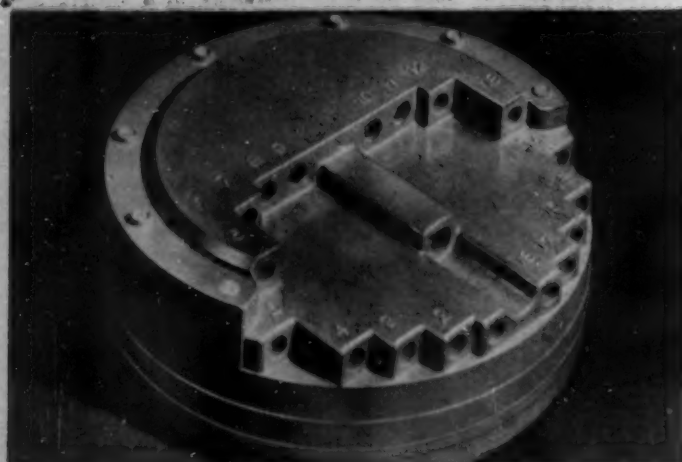
**PREHEATED MELMAC®** molding powder is measured into the pot to be transfer-molded into an aircraft engine distributor head.



(Above) **HEAD IS MOLDED COMPLETE** with 26 electrode inserts, shown being placed in the lower half of the mold. Core pins are placed in upper half to form holes for ignition wires.



(Above) **NUMBER MARKERS** are inserted in holes on the outside of the molded MELMAC head to designate which cylinder is linked with each of the 26 inserts.



(Above) **EACH MELMAC DISTRIBUTOR HEAD** is tested in the laboratory and must withstand 12,000-volt resistance between each electrode.

## **MELMAC DISTRIBUTOR HEADS FOR HIGH ALTITUDE FLYING MOLDED BY FORD**

Thousands of MELMAC distributor heads are serving in the air attack hammering at the invasion front day after day. These efficient plastic parts are operating successfully under the most extreme service conditions known to fighting planes. Molded in large quantities by the Ford Motor Company of Cyanamid's mineral-filled MELMAC, their outstanding performance is due to MELMAC'S unusually high arc resistance, great dielectric strength, high heat and moisture resistance. These same MELMAC properties will be important aids in your postwar manufacture of aircraft and automotive ignition assembly parts, circuit breakers, controls and switches. Your inquiry will receive prompt attention.

# Plastics Newsfront



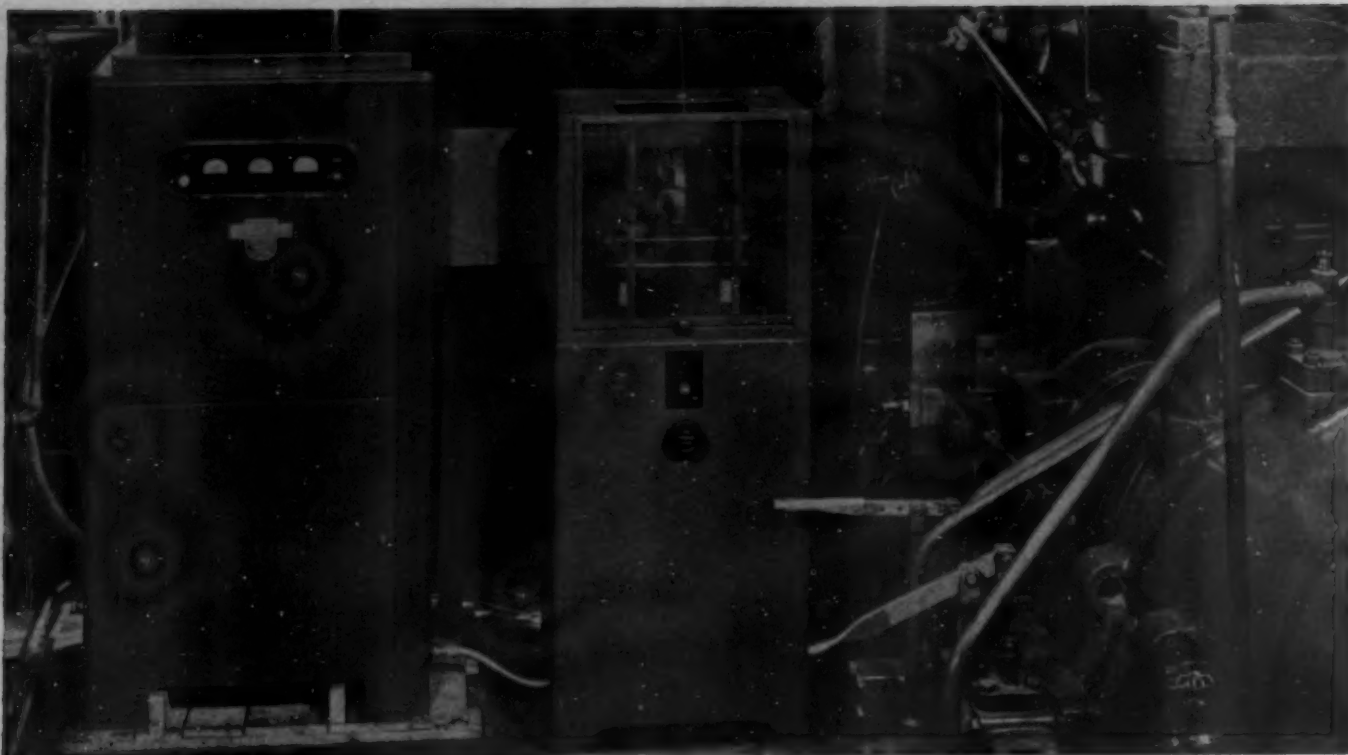
(Above) **SMART, SERVICEABLE, COLORFUL** jewelry packages are molded of BEETLE\* by the Rathbun Molding Corporation, with a special Rathbun hinge. Unusual decorative effects are achieved.

\*Reg. U. S. Pat. Off.

**AMERICAN CYANAMID COMPANY**  
 PLASTICS DIVISION  
 30 Rockefeller Plaza, New York 20, N. Y.  
**CYANAMID PLASTICS**  
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(Above) **REMEMBER THIS CLOCK** with molded BEETLE housing? BEETLE's color, durability, strength, and insulating properties make it ideal for housings of all types.



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1

## Short waves and transfer molding

by J. P. MORAN\* and G. P. BOHRER†

**D**URING the past few years, under the impetus of war, the plastics industry has been called upon to furnish larger and more intricate parts—many with metal inserts—as replacements for assemblies formerly constructed of metal. Many of these plastic components are required to have physical characteristics approaching, or exceeding, those present in the metallic design. In meeting these demands, the molder is confronted with several problems. Not only must he handle a greatly increased mass, but at the same time in order to obtain good results with the new materials, he must cope with a necessary increase in flow properties. Too, there is the additional problem of intricate mold designs.

Because of the aforementioned physical requirements of these parts, the trend has been to use thermosetting phenolic resins that have a large percentage by weight of macerated cotton fabric as a filler. However, such a molding compound is about the most obstinate and difficult material to handle by conventional means. While excellent results have been obtained in the use of high-frequency dielectric heating in plastic molding, in no case has this method of heating shown its worth when used for materials of this type. The following discussion represents experience gained during continuous 24-hr. per day production over a period of approximately 3 months in the use of high-frequency electric energy to preheat preforms of this type of material. This particular process was developed as a result of a cooperative research program carried on since early 1943 by the molding company and the manufacturer of the high-frequency oscillator.

In using conventional methods for the preheating of high-

impact material, several problems present themselves due to the greater density and lower thermal conductivity of the material. Ovens of either the static or circulating air type are at a distinct disadvantage because the heat must be forced into the material from the outside by thermal conduction. As pointed out above, this action is in opposition to the natural physical properties of these materials. Furthermore, it is a known fact that the plasticizing of thermosetting materials

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\* Project engineer, Induction Heating Corp.  
† Superintendent, Plastic Manufacturers, Inc.

by heating is a time-temperature function. If the material were allowed to remain in an oven long enough to become plasticized at its core, some of the outside layer would be "set up" before the material reached the mold. This effect becomes more pronounced if the temperature is raised and the time shortened, thereby increasing the temperature gradient across the piece.

If on the contrary, the temperature is lowered and the time lengthened, the material never reaches full plasticity and requires greater pressures and longer curing time before the final desired results are obtained. In addition, in this latter case, the mold temperature is much higher than that of the preform upon entrance into the mold. Consequently a certain amount of heating of the material must take place within the mold itself during the flow. Since this heating occurs only where there is intimate contact between the molding material and the wall of the mold, it is definitely indicated that progressive polymerization takes place whereby the material in contact with the mold polymerizes first. This action results in the product having a laminar structure with inherently poor physical characteristics. In transfer molding, this problem becomes more acute because of the necessity for quickly "transferring" the material from the "pot" into the mold before partial polymerization occurs.

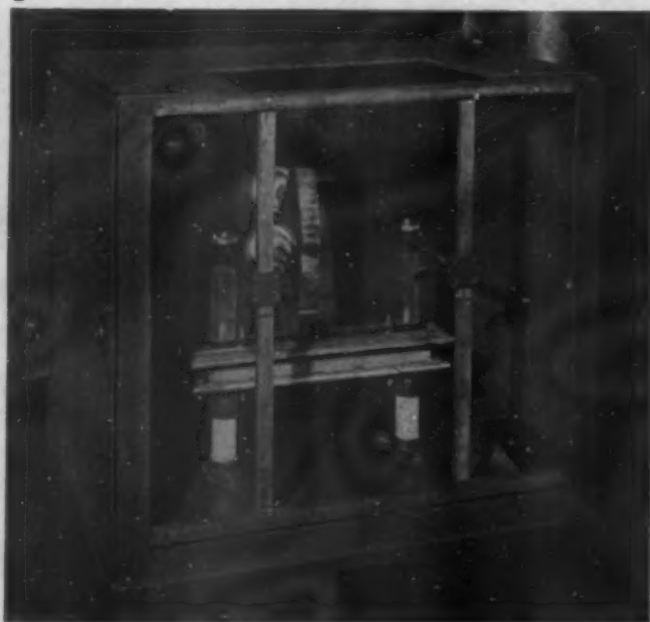
High-frequency heating is a phenomenon by which individual particles of a nominally non-conducting material are heated by what is known as dielectric hysteresis. As a result of placing a given material in an alternating electric field, individual molecules of that material become distorted due to the action of the electric field on the molecules' individual electrons. The movement of these electrons in their distorted orbits represents an energy transfer which is so often discussed as the release of atomic energy brought about by changing the electron path from one radius to another. In effect, this energy release is comparable to dielectric heating and can be looked upon as similar to the action which takes place in the compression and release of a sponge-rubber ball.

Inasmuch as this energy release is uniform in all molecules subjected to the alternating electric field, the mass is heated throughout. The only gradient which occurs shows a temperature higher at the center of the material than on the outside due to the natural radiation of the material. However, with properly designed equipment this difference in temperature can be minimized to a negligible value. Thus, dielectric heating is ideally adapted to preforms and eliminates many of the difficulties encountered when conventional types of heating were employed.

It is believed that there is another effect of high-frequency dielectric heating which greatly enhances its value with respect to the polymerization of thermosetting plastics. Polymerization is looked upon as a physico-chemical reaction in which an intermolecular change takes place. Inasmuch as this change requires a certain amount of energy and our conception of high-frequency heating is of molecular agitation, there is reason to believe that aside from a true temperature reaction, the molecular agitation caused by high-frequency heating greatly accelerates the intermolecular change that takes place during polymerization.

The particular application covered in this discussion is the transfer molding of ball-bearing aircraft pulleys. These pulleys are molded of a phenolic material in 5-cavity dies using an angle press of approximately 200-ton capacity. The preform measures  $1\frac{3}{4} \times 12\frac{3}{4}$  in. and weighs 7 ounces. The high-frequency dielectric heating installation (Fig. 1) consists of a  $3\frac{1}{2}$  kw. output generator taking energy at 205/245 volt, 60 cycle, and supplying energy to the electrodes at 20 mg. with a maximum of 5000 volts. The electronic tubes used for this conversion consist of 2 air-cooled rectifier tubes and a single water-cooled oscillator. The electrode cabinet, where the actual heating occurs, is shown adjacent to the generator in Fig. 1. It contains, in addition to the electrodes, the resonator or tuning device which is operated by the knob on the front of the cabinet. In order to obtain optimum results, initial adjustment of the resonator is made for the particular

1—In this high-frequency heating installation the electrode cabinet is placed close to the  $3\frac{1}{2}$ -kw. generator. The press can be seen at the extreme right. 2—The use of high-frequency heating for the molding of these pulleys shortened the curing time by 50 percent. 3—To provide a clearer view of the preform while in position between the electrodes, the safety gate was removed for this photograph. 4—When the safety gate is open all electrical current is shut off. This arrangement permits the operator to remove the preform without fear of shock



preform being heated. No subsequent adjustment is necessary. Indications of maximum output and proper adjustment are shown by instruments on the front of the generator.

One feature of the electrode cabinet is the action of the safety gate which, in opening, not only de-energizes the electrodes but lifts the upper electrode away from the preform. This arrangement automatically maintains the electrodes in proper position during the loading and unloading of the preforms. The height of the upper electrode is adjustable to accommodate preforms of various thickness, and electrodes of various sizes and shapes can be installed whenever necessary, to conform to the preform.

In preheating by high frequency, considerable vapor is released from the material. In production, when preforms are being heated at the rate of one every 4 min. for 24 hr., an appreciable amount of resin is deposited. After some hours of operation concentrations of cured resin can be noticed at various points on the electrodes, and flash-over ultimately takes place. In addition, the vapor released from the sides of the preform has a tendency to ionize due to the potential existing between the plates. This is another source of flash-over trouble. It was because of these conditions that the first electrodes which consisted of flat copper plates supported on stand-off insulators, proved unsatisfactory.

With these effects in mind the next electrodes were designed to facilitate the dissipation of the vapors evolved. They were made of brass wire mesh bound around the edge with metal tubing so as to eliminate any possibility of flash-over due to point discharge. In order to mount such an electrode, it was necessary to block the openings of a section of the mesh. While electrodes of this type performed more satisfactorily than the flat plates, in time the section of the mesh that was covered by the mountings accumulated the resinous deposit and created a high spot on the electrode which resulted in uneven heating. These mesh electrodes also presented a difficult cleaning problem.

The design that was ultimately adopted consists of metallic rods so spaced as to produce a uniform high-frequency field at the top and bottom surfaces of the preform. To all practical

purposes, line contact is made with the material, and any resin condensation on these rods must, of necessity, take place on those parts of the rods which are not in contact with the preform. This type of electrode can be used continuously for 24 hr. without cleaning. The cleaning operation is then a simple matter. It is only necessary to remove the condensed material from the longitudinal slots between the bars, and this may be accomplished without removing the electrodes from the cabinet.

The generator may be located at any distance up to 15 ft. from the electrode cabinet and the cabinet may, in turn, be mounted directly on the molding press or at a point nearby. The leads from the generator to the electrode cabinet are enclosed as shown in Fig. 1, and the electrode cabinet is completely shielded and grounded for protection of the operator.

While much has been written recently regarding the advantages to be obtained from the use of high frequency in the preheating of plastics, the operation of this installation 24 hr. a day for 3 mon. has produced some valuable data. Primarily, it substantiated the results of laboratory experiments which showed:

1. Ability to preheat uniformly.
2. Faster press closing.
3. Complete and uniform flow.
4. Shorter curing time.
5. Lower ram pressures.
6. Less tool maintenance.
7. Improved product.

*Ability to preheat uniformly*—This quality was covered in the discussion of the fundamentals of high-frequency dielectric heating.

*Faster press closing and complete and uniform flow*—These two advantages may be coupled since the former is the direct result of the latter. Obviously, the faster press closing is important because it reduces the time of the molding cycle and thereby increases production. A preform which has been heated by high frequency is relatively fluid when placed in the press. Therefore, no pause in the stroke of the ram is necessary before flow starts. Such a (Please turn to page 166)

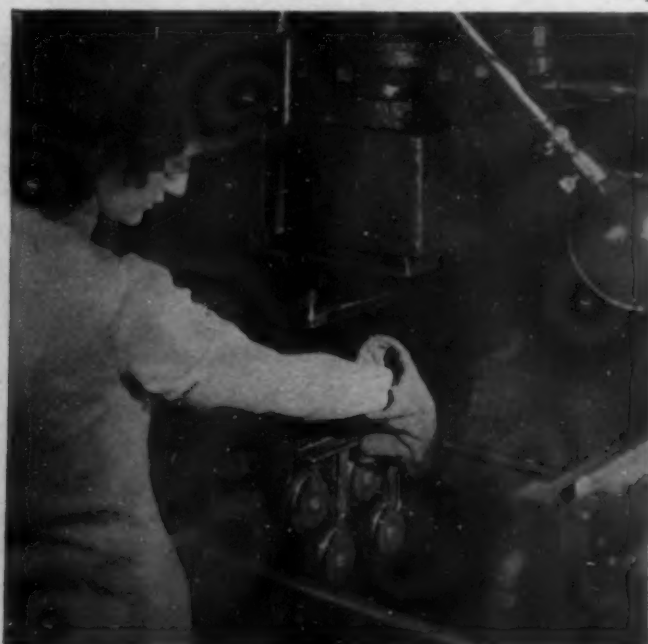
5—The soft condition of the material is clearly evident in this preform which is being inserted in the transfer pot. 6—A complete shot of 5 pulleys including the cull and runners is being removed from the mold. Mold motion is actuated by the horizontal ram of the angle press. The transfer plunger is operated by a vertical ram

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5



6



# Signal Success

OVER a million Tenite whistles have been issued to Navy personnel traveling in dangerous waters. In the event of sea disaster, these whistles are used to attract the attention of rescuers through fog, darkness, and rough water. The shrill blast of the whistle carries farther than a shout and requires much less effort.

Under adverse conditions, this small piece of equipment remains in perfect working order. Tenite is an extremely tough plastic and is virtually proof against distortion or breakage from hard blows. Unlike metal, it will not corrode, and in extremes of temperature, it remains pleasant to the touch. The whistles are injection-molded—the process by which Tenite is converted into finished products at the fastest speeds ever attained with plastics.

Tenite whistles were first sold as toys, later adopted by police organizations, air raid wardens, and the U. S. Army. For further information about Tenite and its uses, write TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENN.

**TENITE REPRESENTATIVES . . .** *New York, 10 East 40th Street. Buffalo, 1508 Rand Building. Chicago, 1564 Builders' Building. Dayton, Ohio, 305 Third National Building. Detroit, 904-5 Stephenson Building. Leominster, Massachusetts, 39 Main Street. Washington, D. C., 1125 Earle Building . . . Pacific Coast: Wilson & Geo. Meyer & Company—San Francisco, 15th Floor, 333 Montgomery Street. Los Angeles, 2461 Hunter Street, Seattle, 1020 4th Avenue, South.*

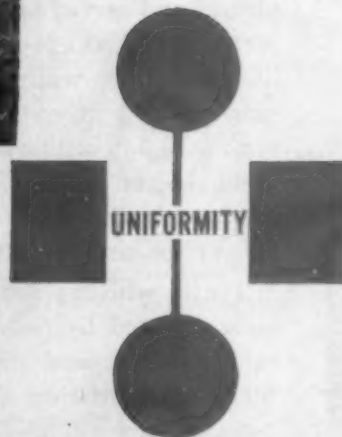
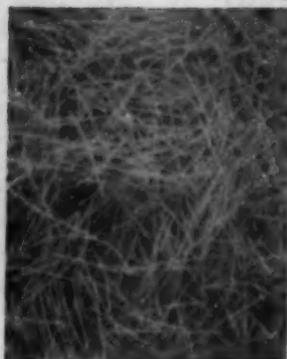
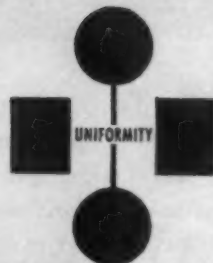
*Whistles molded by T. F. Butterfield & Co., Eclipse Molded Products, Great American Plastics Co., and Plastics Engineering Co.*

# Tenite

*An Eastman Plastic*



# UNIFORMITY



Spare the rod and you spoil the filler! Claremont's job is to toughen cotton fibers — to physically build them up into strong, well behaved plastic mixers. You don't do this by the "anything goes" rule . . . You do it by processing out all extraneous matter such as metal particles, minerals, sizing . . . and all strays of wool, silk, rayon and the like. Then you grade the result and in each grade you make certain that length, bulk and cleanliness answer uniformity's requirements. Claremont's fillers when graduated are fit to meet molding specifications.

**CLAREMONT WASTE MANUFACTURING CO.**  
CLAREMONT, NEW HAMPSHIRE

# TECHNICAL SECTION

DR. GORDON M. KLINE, Editor

## Effect of environmental conditions on mechanical properties of organic plastics\*

by T. S. CARSWELL and H. K. NASON†

### PART I

**A**N INTIMATE knowledge of the behavior of engineering materials under all conditions of use has long been recognized as a prerequisite to intelligent engineering design. The unusual scope of this war has reaffirmed this axiom and, by the imposition of hitherto unencountered environmental conditions, has made necessary the determination of exact material properties over a wide range of temperatures, humidities and stresses. Fighting machinery must function dependably in every part of the world and in all kinds of weather—the price of failure is too high to permit of any doubt. Every part of a fighter plane must behave as perfectly in the frigid, thin, dry air at 40,000 ft. as in the hot, humid jungle atmosphere into which it may be plunged a few minutes later, and this behavior must be predictable. The acquisition of reliable test data at extremes of environmental conditions, as well as data on service behavior of components at the ends of the earth and on its roof, has been a valuable accomplishment of these war years.

While all engineering materials are more or less sensitive to their physical and chemical environment, most organic plastics appear to be especially so. Variations in temperature over the normal terrestrial range ( $-80$  to  $+160^{\circ}$  F.) can cause changes in mechanical properties which would take place in metals only over a much broader temperature scale. Moisture has a profound effect on the properties of many organic materials, and specific chemical agents must be considered also. Light, oxidation and the composite actions known as weathering, influence the permanence of organic materials and the susceptibility to them must be evaluated exhaustively for each plastic product. Finally, the time scale of an acting force may greatly affect the mechanical behavior of a material, and its effect must be considered in the solution of mechanical design problems.

Some of the more important mechanical properties which must be evaluated for each plastic material are: 1) tensile, flexural, compressive and shear strengths; 2) stiffness and rigidity; 3) ductility; 4) impact resistance; 5) creep and stress endurance; 6) fatigue characteristics; 7) dimension stability; 8) physical durability.

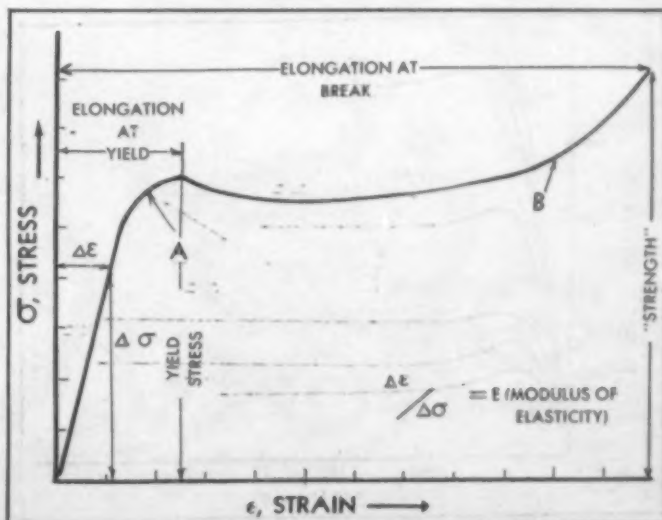
The stress-strain curve, whether in tension, compression, bending or shear, provides a wealth of information concerning

the mechanical properties of a material, and a careful examination of stress-strain data at several conditions of temperature (or of other ambient variables) will usually furnish a reasonably accurate picture of the material's behavior.

The stress-strain curve of nearly any plastic material at equilibrium with any environment can be represented by a portion of Fig. 1, provided that: 1) the curve is obtained by a constant-rate-of-straining type of test, and 2) the point of rupture of the test specimen may occur at any point on the curve. Thus the behavior of a typical ductile material, such as cellulose acetate, at room conditions, may be represented by the entire curve, with the break occurring at point *B*. The behavior of a relatively non-ductile material, such as polystyrene, may be represented by the early portion of the curve only, with rupture occurring at point *A*.

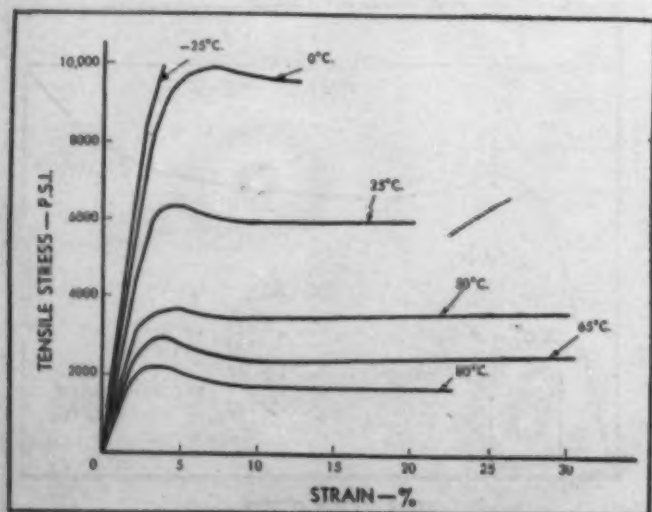
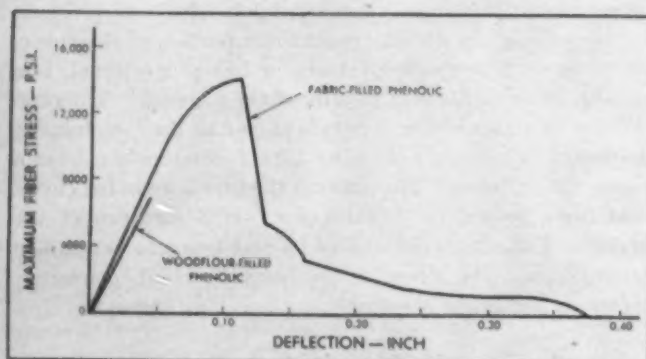
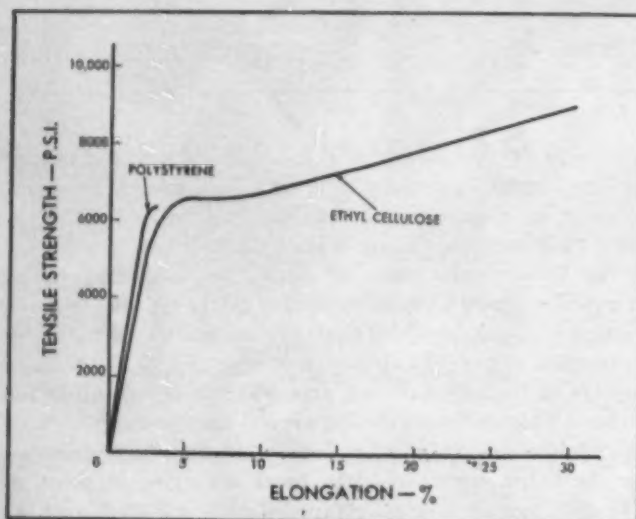
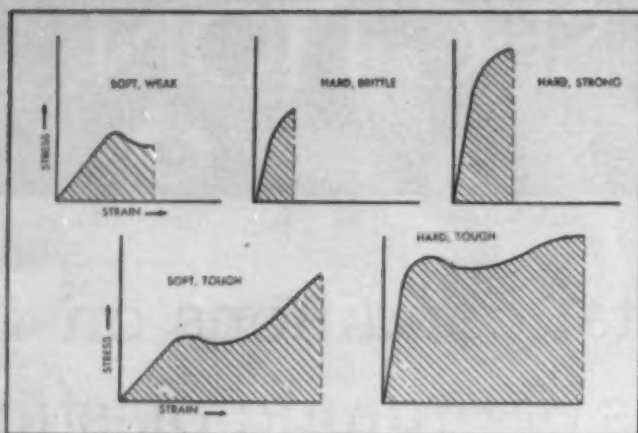
The slope of the initial, straight-line portion of the curve, where stress and strain are more or less proportional, is a measure of the stiffness or rigidity of the material. The ratio of stress to strain in this region is known as the "modulus of elasticity" or "Young's modulus," and is commonly used as a measure of stiffness. The stress at the first knee in the curve, sometimes known as "yield point," is a measure of the strength of the material and of its resistance to permanent deformation. The stress at the breaking point, commonly known as "ultimate strength" or "breaking strength," is a

1—Generalized tensile stress-strain curve



\* Presented at the A.S.T.M. Symposium on Plastics held in Philadelphia, Pa., on Feb. 22-23, 1944, and published here through the courtesy of the American Society for Testing Materials.

† Research Dept., Plastics Division, Monsanto Chemical Co.



measure of the force required to fracture the material completely. In those portions of the curve before the "yield point" is reached, elongations are, in large part at least, recoverable and are a measure of elastic deformation. The elongation from the yield point to the point of rupture, however, is not immediately recoverable, and is a measure of plastic deformation. The area under the stress-strain curve, which represents the work required to fracture the test specimen, is a rough measure of toughness.

In general, *soft, weak* materials show low modulus, low yield point, low elongation at rupture. *Hard, brittle* materials show high modulus, no well-defined yield point, low elongation at break. *Soft, tough* materials show low modulus, low yield point, high elongation and high stress at break. *Hard, strong* materials show high modulus, high yield point, moderate elongation. *Hard, tough* materials show high modulus, high yield point, high elongation, high breaking stress. Stress-strain curves representative of these types of materials are shown in Fig. 2.

Figure 3 illustrates these ideas for "brittle" and "tough" thermoplastics, i.e., polystyrene and ethyl cellulose, and Fig. 4 provides similar illustrations for "brittle" and "tough" thermosetting plastics, i.e., woodflour-filled and cotton-cord-filled phenolic plastics, respectively.

### Temperature effects

Temperatures ranging from  $-40$  to  $+120^{\circ}\text{F.}$  are commonly encountered in the continental United States. Since the development of high-altitude flying, temperatures as low as  $-70^{\circ}\text{F.}$  may be reached in less than an hour over nearly any spot on the globe, and even lower readings have been reported. Metal equipment standing in the sun can easily reach temperatures of  $160^{\circ}\text{F.}$  in the southern parts of the country, and temperatures exceeding  $200^{\circ}\text{F.}$  have been measured inside the wing structures of metal aircraft on the North African desert. Designers of military materiel now consider that temperatures from  $-60$  to  $+160^{\circ}\text{F.}$  are routine limits which may be encountered by any piece of equipment. Hence a knowledge of material properties over this range is necessary.

With all true thermoplastics and with the less highly cross-linked thermosetting materials, the stress-strain curve changes in the following ways as the ambient temperature is varied:

1. The slope of the initial "hookean" or "elastic" portion changes, decreasing as temperature is increased or increasing as temperature is decreased.
2. The magnitude of the maximum stress at the "yield" point changes, decreasing as temperature is increased or increasing as temperature is decreased (except that at very low temperatures ductility may be so low that rupture will occur well down on the linear portion of the curve and before the maximum potential stress can be attained).
3. The point of rupture tends to move along the curve, toward higher values of strain as the temperature is increased or toward lower values of strain as the temperature is decreased. Thermosetting materials follow the first two of these principles, although to a lesser degree than thermo-

2—Tensile stress-strain curves for various types of materials. 3—Tensile stress-strain curves for a brittle (polystyrene) and a tough (ethyl cellulose) thermoplastic. 4—Flexural stress-strain curves for a brittle (woodflour-filled) and a tough (fabric-filled) thermosetting phenolic plastic. 5—Effect of temperature on tensile stress-strain properties of cellulose acetate

plastics, and tend to follow the third; only primary chemical linkages which cannot be strained beyond a certain limit without initiating rupture, restrict ductility of such materials at high temperatures.

A plastic which is "tough" and ductile at room temperature, e.g., cellulose acetate (151),<sup>1</sup> may become "brittle" and hard at low temperatures. Stress-strain curves illustrating this type of behavior are shown in Fig. 5. Similarly, plastics which are "brittle" and hard at room temperature, e.g., polymethyl methacrylate, may become "tough" and ductile at elevated temperatures. Stress-strain curves illustrating this are shown in Fig. 6 (148). This kind of behavior is not limited to organic plastics by any means; many metals behave similarly, although usually over a much wider range of temperatures.

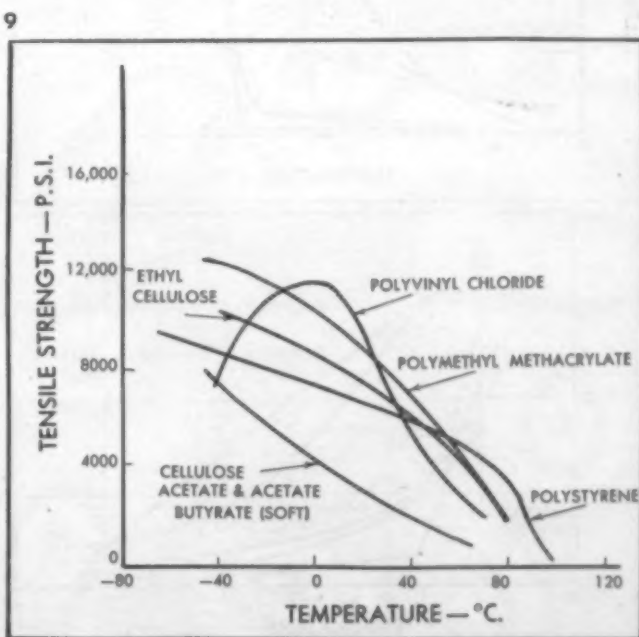
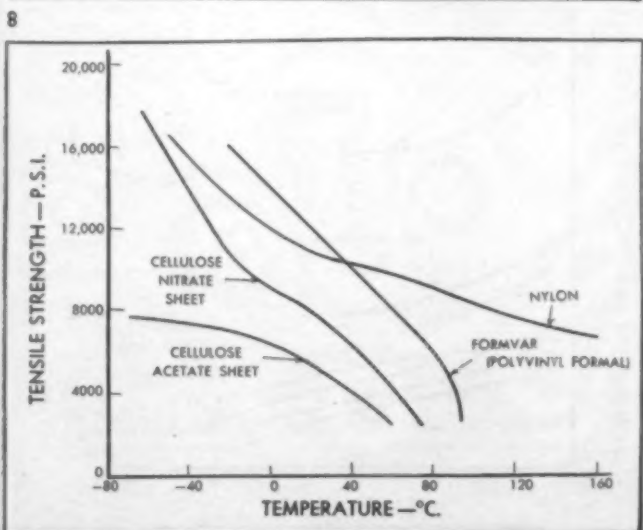
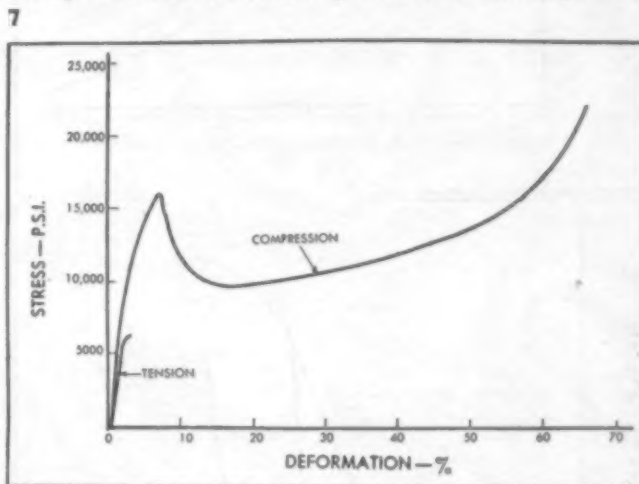
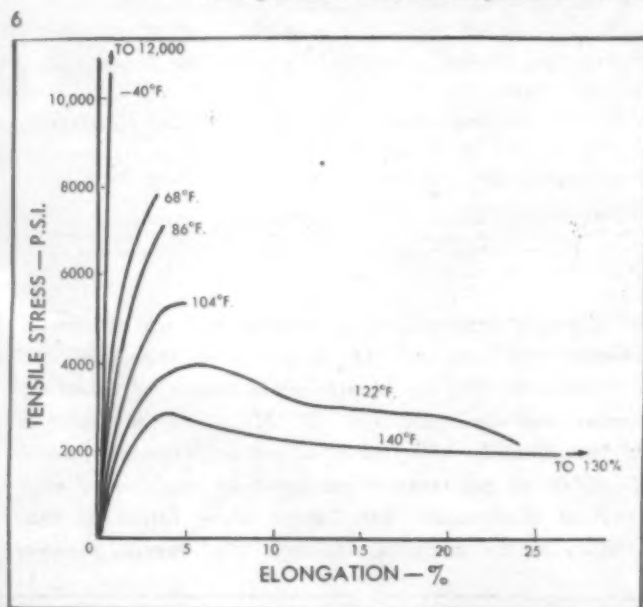
Because of variations in stress distribution and in magnitude of combined stresses (tension, compression and shear) acting simultaneously, it is possible for a material, held at constant temperature, to be "tough" and ductile under one set of test conditions but "brittle" and hard under another. For example, the stress-strain curves shown in Fig. 7 illus-

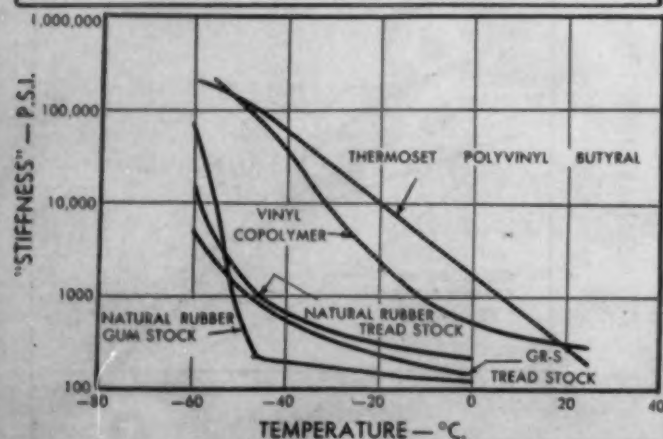
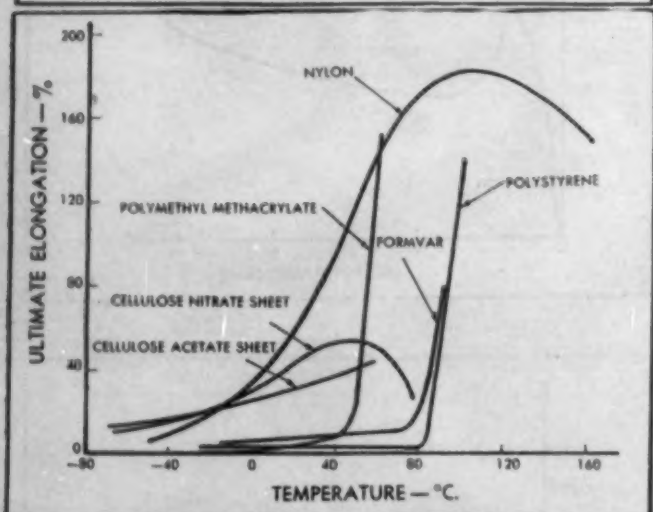
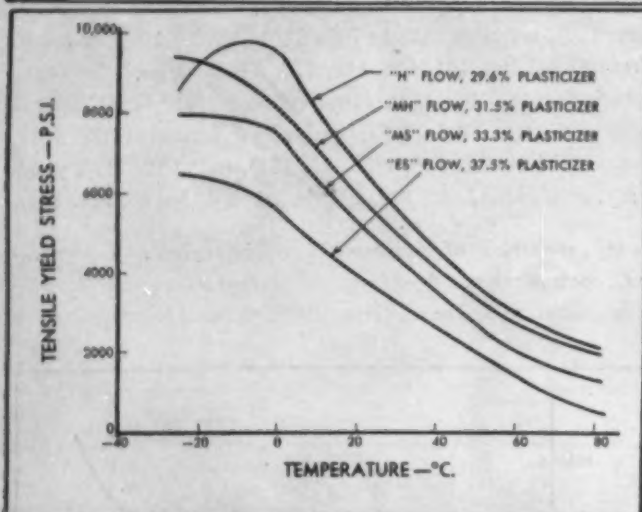
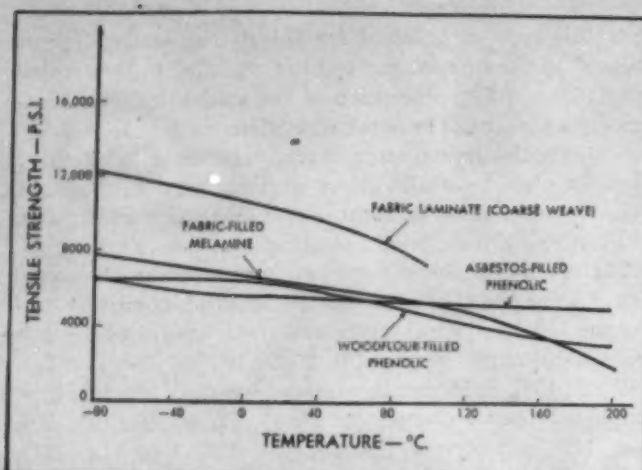
<sup>1</sup> Numbers in parentheses refer to literature citations at the end of this paper.

trate this type of behavior for polystyrene which appears "tough" in the compression test but "brittle" in the tension test (135). A fair conception of the mechanical characteristics of a plastic can be obtained by determining stress-strain curves over the desired range of temperatures and evaluating these for elastic modulus (slope of linear portion), stress at "yield" point, stress at rupture and elongation at rupture. The last two of these are the most familiar test values.

The effect of ambient temperature on the strength properties of a number of plastics has been studied intensively during the last few years. Data have been published for cast and molded phenol plastics (21, 35, 80, 94, 102-106, 112, 121, 125, 150, 154), molded aminoplastics (8, 94, 103, 104, 112, 121), laminated phenol plastics (4, 18, 43, 77, 80, 97, 103, 104, 106, 112), polystyrene (19, 20, 103, 104, 106, 112, 121), polymethyl methacrylate (6, 7, 80, 103, 104, 106, 112, 118, 120, 121, 150), cellulose nitrate (64, 84, 112, 123, 128), cellulose acetate (84, 103, 104, 106, 112, 119, 128, 150), cellulose acetate butyrate (106, 112), ethyl cellulose (112, 128), benzyl cellulose (103, 104, 128), polyvinyl formal (112, 151), polyvinyl butyral (106, 112, 115, 151), nylon (2, 112), polyvinyl chloride (13, 80, 103, 104, 106, 112, 115, 116, 121, 124),

6—Effect of temperature on tensile stress-strain properties of polymethyl methacrylate. 7—Stress-strain curves of polystyrene in tension and compression. 8—Effect of temperature on tensile strength of several thermoplastics. 9—Effect of temperature on tensile strength of several thermoplastics





casein plastics (103, 104, 112, 118) and rubber (65, 105, 130, 132, 137).

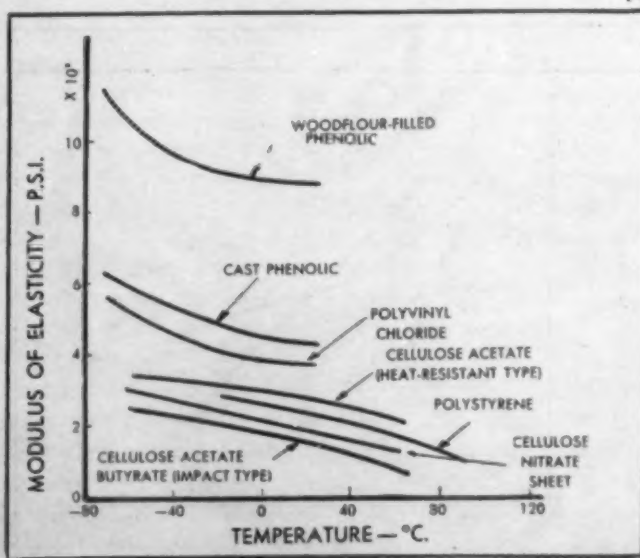
Data<sup>2</sup> showing the effect of temperature on tensile properties are summarized in Figs. 8 to 15, inclusive. Figures 8 and 9 show data for tensile strength of several common thermoplastics, and Fig. 10 shows comparable data for several thermosetting plastics. To demonstrate the effect of formulation on the properties of a plasticized composition, Fig. 11 shows tensile yield stress as a function of temperature for four cellulose acetate molding materials of varying plasticizer content. Figure 12 shows the effect of temperature on the elongation at rupture for several common thermoplastics. Very few data are available concerning the effect of temperature on the elongation of thermosetting plastics, largely because of the difficulty of measuring the very small extensions exhibited by these materials.

The effect of temperature on the modulus of elasticity of several thermoplastic and thermosetting materials is shown in Fig. 14. The effect of formulation on the modulus of elasticity of a plasticized cellulose acetate composition is shown in Fig. 15. For elastomeric materials, where flexibility and "rubberiness" are desired properties, appreciable increase in stiffness at low temperatures may be very disadvantageous since, if severe enough, it may prevent the proper functioning of vital parts when exposed to arctic or stratospheric cold. The effect of temperature on the stiffness (i.e., apparent modulus of elasticity) of such materials has received considerable attention recently (3, 26, 27, 28, 57, 71, 86, 115, 116, 124, 130), and data for several elastomeric plastics are shown in Fig. 13.

At very low temperatures, rubber and other elastomeric plastics become both stiff and brittle. While stiffness increases gradually, brittleness, under fixed test conditions,

<sup>2</sup> Data shown in this paper are intended for comparative purposes only. Since not all data in any one figure have necessarily been determined by exactly the same technique, care should be taken not to interpret test values too literally.

10—Effect of temperature on tensile strength of several thermosetting plastics. 11—Effect of temperature and of formulation on the tensile yield stress of injection-molded cellulose acetate. 12—Effect of temperature on the ultimate elongation of several thermoplastics. 13—Effect of temperature on apparent modulus of elasticity of elastomers. 14—Curves show effect of temperature on the modulus of elasticity of several plastics



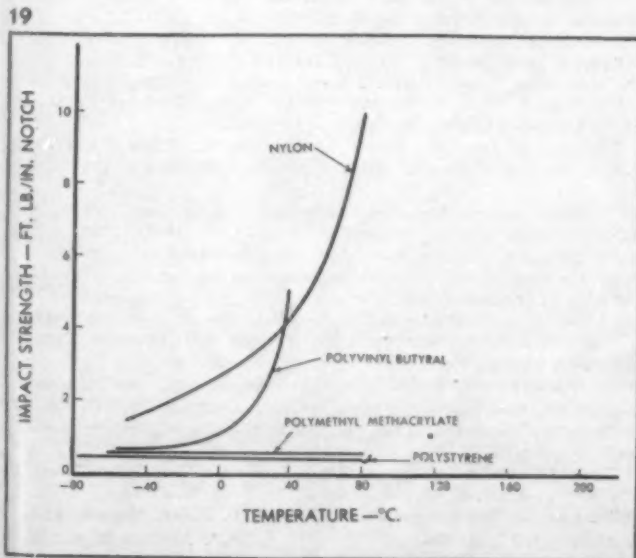
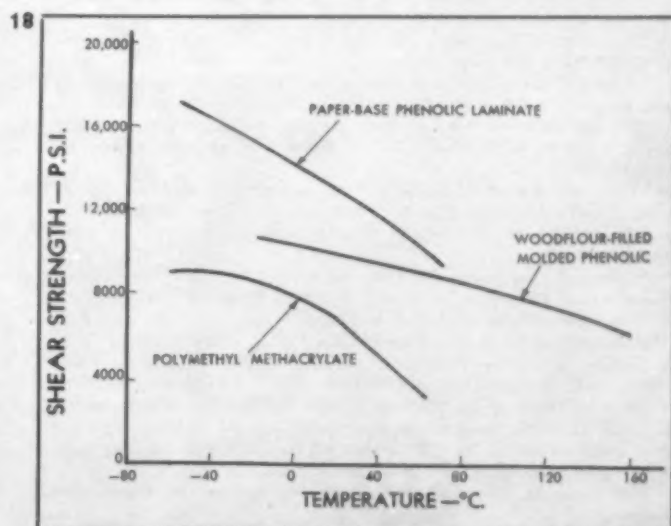
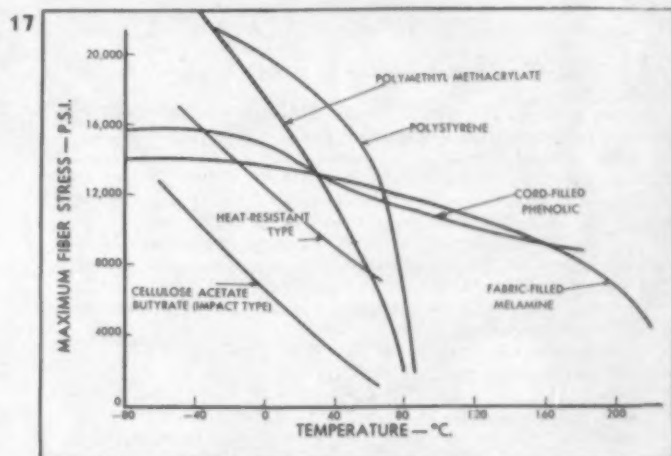
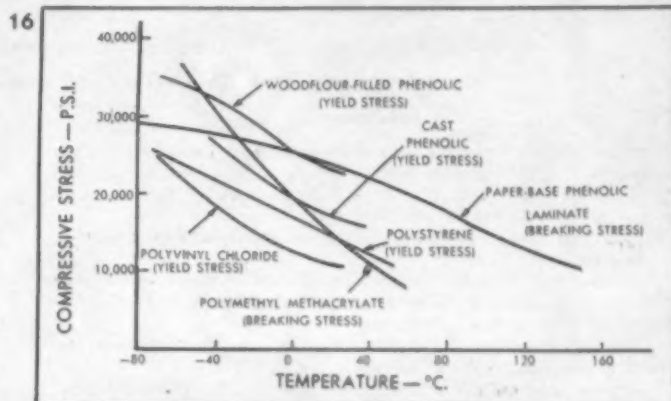
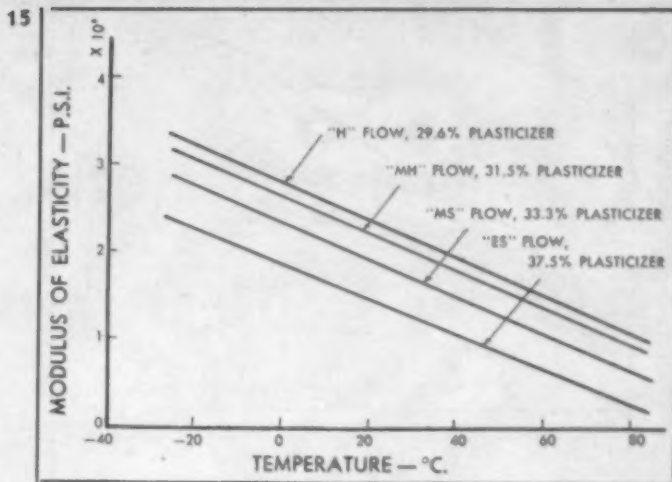
seems to occur at a rather sharply defined temperature. This "brittle point" is widely used as a characteristic property of rubbery materials. It probably represents the temperature at which both elastic modulus and plastic viscosity become so high that sufficient deformation cannot take place rapidly enough to prevent the stresses imposed in a short-time test from exceeding the strength of the material. Considerable data on brittle points have been published recently (3, 28, 57, 69, 70, 71, 76, 96, 124, 129, 130, 157).

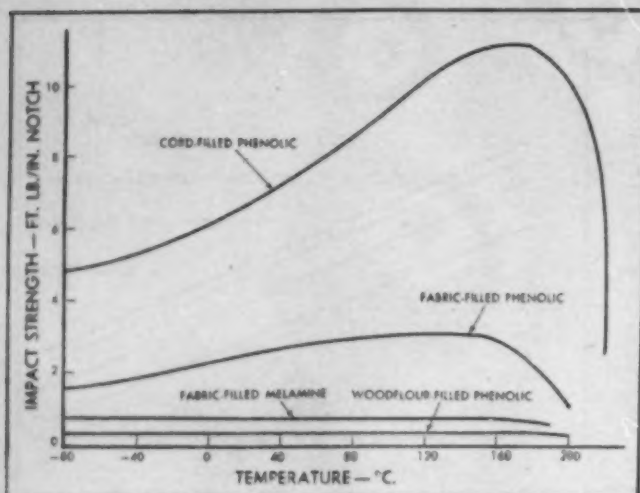
The compressive properties of plastics show about the same response to ambient temperature as do tensile properties. Data showing the effect of temperature on the compressive strength of several materials are given in Fig. 16. It is worth noting that compressive yield stress is much more satisfactory as an indication of compressive strength of soft highly ductile plastics than is the stress at the point of rupture. Between these two points the plastic is radically deformed with a large change in shape and dimensions.

The effect of temperature on flexural strength properties is shown in Fig. 17. Flexural properties are affected by formulation in much the same way as are tensile properties (Figs. 11 and 15). Relatively little information concerning the effect of temperature on shear strength has been published. Figure 18 shows data for polymethyl methacrylate, a woodflour-filled phenolic and a paper-base phenolic laminate. It can be seen that shear strength varies with ambient temperature as do tensile and flexural strength.

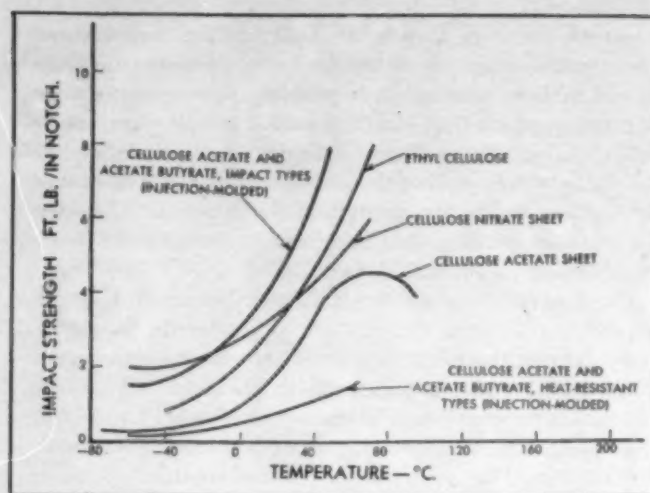
The impact test is commonly accepted as a measure of the toughness of a material. Although the quantitative significance of impact data is still disputed, the results of the Charpy and Izod tests do provide a comparative basis for estimating the relative shock resistance of plastic materials. The results usually correlate fairly well with tensile and flexural data. The effect of ambient temperature on Izod impact strengths of several plastics is summarized in Figs. 19, 20 and 21. (Please turn to next page)

15—Curves showing the effect of temperature and of formulation on the modulus of elasticity of injection-molded cellulose acetate. 16—Effect of temperature on the compressive strength of several plastics. 17—Effect of temperature on the flexural strength of plastics. 18—Effect of ambient temperature on the shear strength of plastics. 19—Curves showing the effect of temperature on the impact strength of several plastics





20



21

20—Curves showing the effect of temperature on the impact strength of several plastics. 21—This chart indicates the effect of temperature on the impact strength of several plastics

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(Please turn to page 158)



## How to solve arcing problems in wartime electrical equipment

These Army-Navy connector inserts  
were molded from Resimene 803A.

In the design of World War II electrical equipment, space-saving is always an important consideration and, accordingly, electrical insulation spacing is often held to a minimum. As a result, arcing under severe humidity conditions is more likely to occur.

Phenolic plastics, which have successfully met all other requirements for so many years, have relatively low arc resistance. In fact, none of the commonly used insulations which could be fabricated into finished parts with speed and economy were satisfactory.

### Resimene solves problem

Fortunately, here is a solution to that problem: Resimene 803A, a cellulose-filled melamine-formaldehyde compound with the high arc resistance of a melamine and the moldability of a general purpose phenolic.

Resimene 803A was developed specifically for AN connector inserts formerly molded from a general purpose phenolic. In tests of its arc resistance with ASTM D495-42 elec-

trode spacing at a current density of about ten milliamperes, it showed no breakdown after 2,000 flashes of one-quarter second duration... while the phenolic formerly used breaks down under two or three arc flashes.

### Resimene easy to mold

Most remarkable feature of Resimene 803A, however, is the fact that this very substantial increase in arc resistance has been achieved with practically no sacrifice of moldability.

Mold shrinkage and after shrinkage are exceptionally low for a melamine material, and, as you would expect, water absorption is low and abrasion resistance high.

Like all melamine materials, Resimene 803A is allocated by WPB and is available only for direct military applications. *Samples and trial orders up to one hundred pounds, however, can be supplied without specific allocation.*

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# TECHNICAL BRIEFS

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

## Engineering

**FORMING PROPERTIES OF VULCANIZED FIBRE SHEET.** C. A. Hedges. *Automotive Aviation Ind.* 90, 40, 64 (Apr. 1, 1944). Experiments were made to determine the best conditions for forming vulcanized fibre. The tests were made with lead-Kirksite dies. The final recommendations are as follows: 1) the vulcanized fibre should be soaked in water or steamed for 5 to 15 min. before pre-forming, 2) the piece must be held in shape until dry—heated tools are helpful, 3) the formed pieces must be coated after drying to prevent warpage caused by subsequent moisture absorption, 4) cups may be drawn to a depth equal to the cup radius, 5) corner radii should be held to a minimum of one inch and 6) except for bending operations, fibre should not be formed if the thickness is more than 0.08 inch. It is noted that the fibre will stretch but has very little tendency to shrink.

**FLAMMABILITY OF PLASTICS.** H. R. Fleck. *Fire* 36, 82-3 (1943). Compounds with open chain structures are easier to ignite than those with ring structures. Chemical reactivity decreases as molecular complexity increases. Therefore, an increase in the degree of polymerization decreases the ease of ignition. Depolymerization of some materials may occur at high temperatures resulting in an increase in flammability. The probability of vapor ignition is increased in an atmosphere laden with plastic dust. Flash points of various solvents and plasticizers are given.

**SAFETY MEASURES FOR USE OF CHLORINATED NAPHTHALENES AND DIPHENYLS IN INDUSTRY.** L. Greenburg. *Ind. Bull. (N. Y. State Dept. of Labor)* 22, 404-7 (1943). Many cases of dermatitis and several deaths due to liver damage were found in two cable plants using chlorinated naphthalenes and diphenyls. One plant used the materials dissolved in petroleum ether and toluene; the acneform dermatitis incident in 10 months was 21 percent. The other plant used hot plastic material; the acneform dermatitis incident was 60 percent in 7.5 months. It is recommended that the cold solvent process be used, that safe handling procedures be employed and that exposed workers be examined periodically.

**FABRICATING WOOD AIRCRAFT "SKINS."** J. P. Taylor. *Electronics* 17, 102-7, 391-2 (Apr. 1944). Techniques for utilizing radio-frequency heating in the

fabrication of thin coverings such as wing and fuselage surfaces from wood and plywood are described. Details of mold design for making curved and reinforced parts are given.

## Chemistry

**METHYL ACRYLATE PRODUCTION BY PYROLYSIS OF METHYL ACETOXYPROPIONATE.** C. H. Fisher, W. P. Ratchford and L. T. Smith. *Ind. Eng. Chem.* 36, 229-34 (Mar. 1944). Contact and construction materials used in the pyrolysis of esters were investigated to determine their effect on the production of methyl acrylate by the pyrolysis of methyl acetoxypropionate. See *MODERN PLASTICS* 20, 99 (May 1943).

## Properties

**THERMOPLASTIC FLOW OF POLYSTYRENE.** N. M. Foote. *Ind. Eng. Chem.* 36, 244-8 (Mar. 1944). Nomographs for calculating viscosity of polystyrene from data on parallel-plate compressions and from data on the filling of a capillary are given. The empirical equation giving apparent viscosities of polystyrene for low stresses as a function of absolute temperature is:  $\ln \text{viscosity} = \frac{40,000}{RT} - 30$ . Viscosities obtained by test methods involving a greater expenditure of work are lower than those obtained from tests involving low work input. It is clear that elasticity is involved in this phenomenon, but whether the greater flow is caused by a slowly recoverable elastic deformation or by some non-recoverable process is not clear.

**MOLECULAR WEIGHT DETERMINATIONS OF CELLULOSE NITRATES.** E. Husemann and G. V. Schulz. *Z. physik. Chem. B* 52, 1-22 (July 1942). The molecular weights of fractionated and unfractionated cellulose nitrates determined by the osmotic method are compared with the intrinsic viscosities. The Staudinger constant is different for the fractionated and unfractionated samples. The constant also depends on the method originally used to degrade the cellulose.

**PLYWOOD CHARACTERISTICS DISCLOSED BY VIBRATION TESTS.** A. J. Yorgiadis and J. M. Robertson. *Aero Digest* 45, 76-7, 80-1, 196, 198, 201-2, 204 (Apr. 1, 1944). The damping capacities of plywoods are such that ply-

wood structures are more resistant to vibration than metal structures. Since the dynamic moduli of elasticity of plywoods and wood differ greatly from their static moduli, computations of resonant frequencies of plywood structures must be based on the dynamic moduli. The damping capacity of plywood is greater than that of structural metals but less than that of plastics. A correlation was found between the damping capacity and dynamic moduli of plastics, plywoods and wood: the higher the modulus of a material, the lower is its damping. For the plywoods, the dynamic moduli increase with specific weight. The damping capacity of plywoods does not vary greatly in the range of ply thicknesses ( $1/16$  to  $1/2$  in.) and molding pressures (500 to 1500 lb./in.<sup>2</sup>) which were investigated. Nor does the damping vary greatly between the woods (birch, gum and poplar) which were tested or with doubling of resin film.

**WATER-VAPOR PERMEABILITY OF CERTAIN COATED FABRICS.** J. T. Stearn and A. S. Cooper, Jr. *Am. Dyestuff Rep.* 33, 150-5 (Mar. 27, 1944). Coating materials suitable for making cool waterproof garments should have a relatively high permeability for water vapor while preventing the passage of liquid water. The results indicate that several synthetic resins and cellulose derivatives should be satisfactory if they are not specifically compounded to make them too highly water resistant.

## Testing

**THERMAL EXPANSION PROPERTIES OF PLASTIC MATERIALS.** R. F. Clash, Jr., and L. M. Rynkiewicz. *Ind. Eng. Chem.* 36, 279-82 (Mar. 1944). A simple dilatometer for determining the volume-temperature relations of plastics is described, and data are reported for a number of thermoplastic materials. Cubical expansion coefficients have been calculated below and above the observed transition temperatures, and the effect of plasticizer addition on these properties is reported. Polyethylene shows expansion characteristics similar to those of paraffin wax but appreciably different from those observed for the other thermoplastics studied.

**THE DETERMINATION OF THE HARDENABILITY OF SYNTHETIC RESINS.** H. Kappeler. *Schweiz. Arch. angew. Wiss. Tech.* 8, 378-80 (1942). The time necessary to change an originally soft resin to a hard friable mass by placing a 20-micron thick film of the material over a heated metal tube maintained at a constant temperature, is taken as a measure of the curing or hardening time of the resin. For hardenable phenol and cresol resins and for hard shellac, the hardening time,  $t$ , is expressed by the following equation:  $t = e^{c(T_0 - T)}$ , where  $T$  is the temperature and  $c$  and  $T_0$  are constants.

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# PLASTICS DIGEST

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals directly to publishers.

## General

**INTER-RELATIONSHIP OF PLASTICS AND CHEMICALS.** J. W. Reynolds. *Chem. Met. Eng.* 51, 109-13 (Mar. 1944). The basic chemical components and the production of commercial plastic materials are discussed. Similar information on raw materials, plasticizers and solvents is given. The following table on production of plastics, compiled by G. M. Kline and presented in a paper at the Cleveland meeting of the American Chemical Society on April 5, is based largely on statistics in this article:

PRODUCTION OF PLASTICS IN MILLIONS OF POUNDS

Plastic material	1940	1943	1944 Est'd
Cellulose compounds			
Nitrate	12	20	20
Acetate	24	53	55
Acetate butyrate			
Acetate propionate	8	32	34
Ethyl cellulose			
Thermoplastic resins			
Polystyrene	2	4	4
Methacrylate	3	37	50 (cap.)
Polyvinyl	18	83	108 (cap.)
Coumarone, indene, etc.	36	55	55
Alkyds	100	100	100
Thermosetting resins			
Phenolics	93	152	176
Ureas	22	65	75
Totals	308	603	700 (Approx.)
Styrene monomer	15	350	405

**SYNTHETIC FIBERS AND THEIR FUTURE DEVELOPMENT.** Am. Dye-stuff Rep. 33, 121-8 (Mar. 13, 1944). A Symposium of the American Association of Textile Chemists and Colorists, consisting of the following articles: Nylon, R. A. Ramsdell; Acetate rayon, H. D. Smith; Viscose rayon, F. Bonnet; and Vinyon, F. Bonnet.

**ARTIFICIAL FIBERS FROM CORPUSCULAR AND FIBROUS PROTEINS.** H. P. Lundgren and R. A. O'Connell. *Ind. Eng. Chem.* 36, 370-4 (Apr. 1944). Proteins in general are potential fiber-building materials. By proper manipulation of proteins derived from surplus and waste agricultural and industrial commodities, fibers have been made with molecular orientation, strength and moisture-absorbing characteristics comparable with those of natural protein fibers. These fibers have been made with dispersing agents which are mild in com-

parison with those commonly used for commercial protein fibers. The agent, alkyl benzenesulfonate, not only serves as a solvent for proteins but also interacts in appropriate mixing proportions with proteins to form complexes.

## Materials

**PLASTICS FROM WOOD AND FOR WOOD IMPROVEMENT.** R. V. V. Nicholls. *Canadian Chem.* 28, 163-5, 191 (Mar. 1944). Plastic products derived from wood and the use of plastics to improve the properties of wood are discussed. The topics covered are: pulp preforming and resin boards, chemical modification of cellulose, lignin plastics, paper laminates, synthetic resin adhesives for plywood, new forming techniques and resin impregnation of wood.

**LAMINATING PAPERS.** A. H. Croup. *Pacific Pulp & Paper Ind.* 17, 18 (Nov. 1943). The types of papers (rag, alpha, kraft and unbleached sulfite) used for lamination are determined by the application of the end product and by economic considerations. Rag paper is the best but it is also the most expensive. Alpha paper is used where uniformity in appearance is essential and where transparency and light colors are desired. Kraft paper, the most widely used material, gives good mechanical and electrical properties. Laminated products made of special unbleached sulfite papers have superior mechanical properties. Bleached pulp papers give products of low strength but good appearance.

## Applications

**FLOW PROPERTIES OF CELLULOSE ESTERS.** C. J. Frosch. *Bell Labs. Record* 22, 269-72 (1944). The substitution of cellulose ester plastics for phenolic fiber in the telephone industry is considered. Cellulose acetate plastics change dimensions and shrink permanently when they are subjected to cyclic changes in moisture content. Cellulose acetate butyrate plastics have a lower water absorption and greater resistance to flow than cellulose acetate plastics. Data are given in graphic form showing the flow properties and Rockwell hardness of cellulose acetate, cellulose acetate butyrate, phenolic fiber and polystyrene plastics in a comparative manner. It is concluded that cellulose acetate butyrate plastic may be suitable as separators in place of phenolic fiber.

**METAL PLUS PLASTIC MAKES NEW AIRCRAFT FLOORING.** *Aviation* 43, 130-1, 240, 243 (Apr. 1944).

Aircraft flooring made of high-strength canvas-base laminated phenolic plastic with aluminum inserts is described. The design consists of a flat sheet bonded to a corrugated sheet. The heel load of flooring weighing one lb. per sq. ft. is approximately 500 pounds.

**SYNTHETIC RESINS IN THE PAPER INDUSTRY.** L. Klein. *Chemical Industries* 54, 364-7 (Mar. 1944). Resins must have the following properties to be suitable for use in paper manufacture: 1) they must be water-soluble or water-dispersible, 2) they must lend themselves to application in the usual paper making operations, 3) they should be odorless, colorless, tasteless and non-toxic, 4) the cost should be low and 5) they must have suitable aging characteristics. Phenolic resins find a very limited application in the manufacture of paper because of their color and the difficulty of applications. Polyvinyl alcohol is the only vinyl resin of interest in paper-making; it is used to increase the wet strength and for grease-proofing. The urea-formaldehyde and melamine-formaldehyde resins are most widely used to increase the dry and wet strengths and durability of paper.

## Coatings

**MECHANISM OF SOLVENT ACTION.** A. K. Doolittle. *Ind. Eng. Chem.* 36, 239-44 (Mar. 1944). Two principal equilibria are simultaneously operative in the solution of resinous substances, solvation-desolvation and aggregation-disaggregation. The rate of desolvation is substantially fixed at constant temperature, but the rate of solvation is a function principally of solvent concentration. The threshold concentration required to initiate the solution process diminishes to a constant minimum value as we ascend a homologous series of solvents. This minimum value, called "class threshold concentration," is independent of the diluent and therefore serves as an absolute comparison of different classes of solvents for a given resinous substance. The aggregation-disaggregation equilibrium of the solute macromolecules depends on the solvation-desolvation equilibrium, since disaggregation results when the "active centers" are solvated.

**ZINLAC—SHELLAC SUBSTITUTE.** R. V. Townsend and C. G. Harford. *Chem. Ind.* 54, 359 (Mar. 1944). A shellac substitute made from zein, derived from corn gluten, is described. This varnish is soluble in denatured alcohol and resembles shellac in many of its properties. It is being used as a label varnish and a priming coat on metals. It is less permeable to moisture than shellac and has excellent electrical properties. This substitute meets the requirements of the new Federal Specification for Shellac Varnish Replacement.

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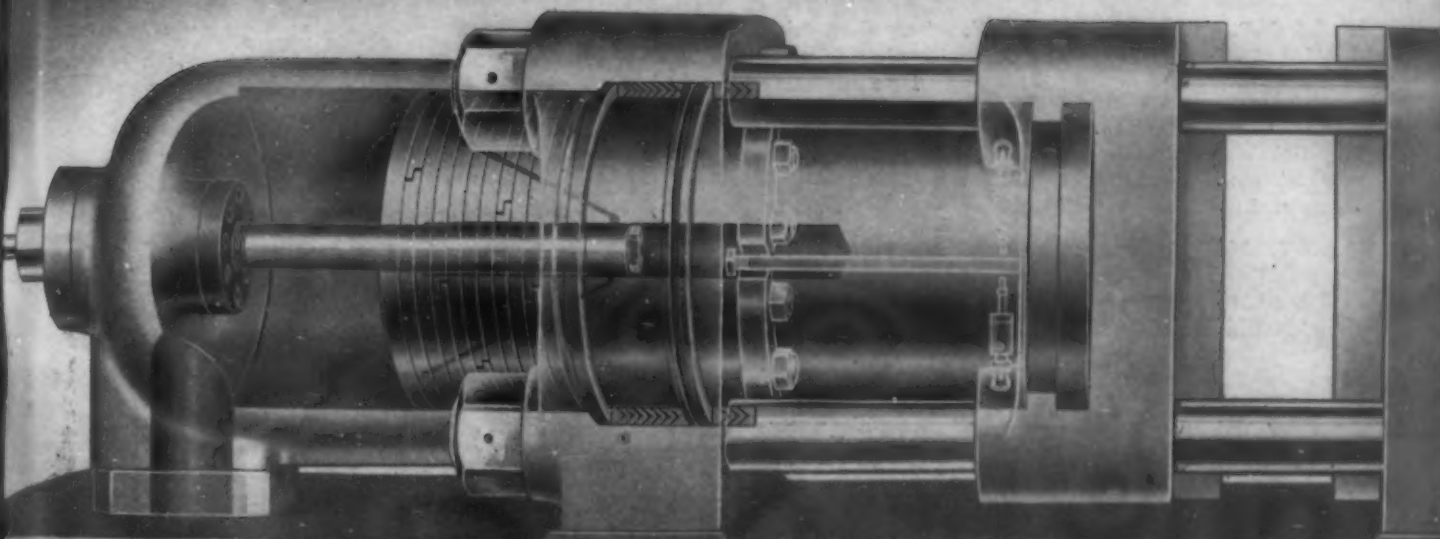
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5 • Automatic Slow Down

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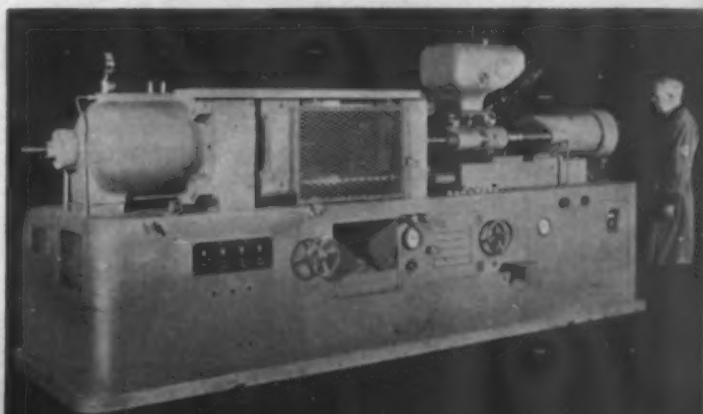
Let's elaborate on just one of the advantages of the hydraulic clamp—"Rapid Die Change-Over." No adjustments are necessary to install molds of different thickness. The clamp ram advances until resistance is met, and this may be anywhere within the limits of the ram travel. What could be simpler!

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# U.S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

**HINGE CAP.** R. P. Magnenat (to Waterbury Companies, Inc.). U. S. 2,342,477, February 22. A container having a pair of molded plastic lugs around the rim for supporting a cap.

**ALLYL POLYMER.** G. W. Hooker, S. C. Stowe and S. M. Stoesser (to Thiokol Corp.). U. S. 2,342,582, February 22. A polymerized reaction product of an alkaline tetrasulfide and an allyl compound.

**GASKET.** H. B. Denman (to Detroit Gasket and Manufacturing Co.). U. S. 2,342,647, February 29. A bearing seal gasket formed of a continuous strip of thin cork convoluted and compressed into a coil, and bonded with a synthetic thermosetting resin.

**SOUND RECORD.** H. Mediger (to Alien Property Custodian). U. S. 2,342,679, February 29. A phonograph record composed of a synthetic linear condensation product having crystalline structure.

**REED.** A. Brillhart (to Arnold Brillhart, Ltd.). U. S. 2,342,830, February 29. A reed for wind instruments, composed of molded plastic.

**LAMINATED STRUCTURES.** E. L. Vidal (to Vidal Research Corp.). U. S. 2,342,988, February 29. Laminated articles comprising several sheets joined with a plastic bonding agent are formed by placing them upon a rigid mold at one point of contact and subjecting them to fluid pressure until the material has assumed the form of the mold, after which the resin is set with the aid of heat.

**THIO-PROTEIN.** O. Huppert. U. S. 2,343,011, February 29. A plastic material is formed by boiling and agitating a mixture of zein, aqueous ammonium sulfocyanide solution and monochloroacetic acid.

**FRAME.** W. I. Adelman. U. S. 2,343,037, February 29. A window frame made from sections of thermoplastic organic material fused and rigidly united.

**TUBES.** W. F. Stahl. U. S. 2,343,096, February 29. A hollow paper tube is coated with a thermosetting resin which is cured by passing through a heated die.

**FIREPROOFING.** H. Hopkinson. U. S. 2,343,186, February 29. A liquid composition, comprising a number of water-soluble salts, at least one of which is a fireproofing agent, capable of reacting to form a water-insoluble fireproofing salt, this salt then being dissolved in a water-insoluble plasticizer for plastic material.

**EMBOSSING.** J. G. Kinlein. U. S. 2,343,191, February 29. A hot stamping die and counter are prepared by sinking characters to be embossed in a die, pressing a thermoplastic counter material, and thereafter relieving the face of the die about the characters to provide clearance between die and counter.

**MOLDED ARTICLES.** E. E. Sawyer (to Canal National Bank of Portland). U. S. 2,343,330, March 7. An article is prepared from a mixture of resin and fibers in a liquid vehicle by suction-forming flat blanks on forming dies, removing the blanks, drying and molding under heat and pressure.

**PROJECTILE.** R. G. Thompson. U. S. 2,343,344, March 7. A projectile comprising a cylindrical body having a bluntly pointed end and a windshield made of rigid thermosetting plastic material.

**HOLLOW VESSEL.** L. Nast (to United Plastics Corp.). U. S. 2,343,470, March 7. A hollow vessel composed of organic thermosetting resin which is solid and heat resistant at elevated temperatures.

**ADHESIVE.** H. H. Harkins (to United States Rubber Co.). U. S. 2,343,551, March 7. An adhesive comprising rubber, a soluble phenol-aldehyde resin and lead chromate in an organic solvent.

**DECORATIVE COMPOSITION.** W. M. Gearhart (to Eastman Kodak Co.). U. S. 2,343,658, March 7. A decorative thermoplastic molding material having a nacreous appearance, consisting of a mixture of a synthetic resin with a cellulose organic acid ester and a plasticizer.

**PLYWOOD.** D. G. Birmingham (to Harbor Plywood Corp.). U. S. 2,343,740, March 7. A hot-pressed laminated product comprising a wood veneer to which is bonded a loosely matted fibrous sheet having a thermosetting resin diffused throughout, which when cured gives a smooth hard surface completely masking the wood grain.

**ROPE STRUCTURE.** M. C. Dodge and N. R. Axelsson (to Columbian Rope Co.). U. S. 2,343,892, March 14. A stranded rope structure is prepared by twisting several yarns of a synthetic thermoplastic resin into strands which are twisted into a rope, immersing the rope in a liquid bath which is heated to a temperature sufficient to soften the yarns and finally cooling to set the twisted yarns.

**MOLDING.** W. W. Rowe (to Cincinnati Industries, Inc.). U. S. 2,343,930, March 14. A laminated textured article is prepared by pressing a creped paper impregnated with resin.

**FURFURYL ALCOHOL-FORMALDEHYDE RESINS.** M. T. Harvey (to Harvel Research Corp.). U. S. 2,343,972-3, March 14. A fusible resin is prepared by reacting a mixture of furfuryl alcohol, formaldehyde and an acidic agent in such proportions as to give a pH of 1.5 to 3.5.

**SHEET MATERIAL.** L. C. Hosfield (to National Carbon Co., Inc.). U. S. 2,343,975, March 14. Films and sheets of thermoplastic resin are welded by passing 2 sheets past a heat-sealing station.

**PLASTIC EYELETS.** C. D. Knowlton (to United Shoe Machinery Corp.). U. S. 2,343,982-3, March 14. Plastic eyelets are set by placing the barrel through a hole, and heating the end with a tool so as to flange the edge, which on cooling maintains the eyelet in position.

**TEXTILE.** E. W. Rugeley and W. M. Quattlebaum, Jr. (to Carbide and Carbon Chemicals Corp.). U. S. 2,344,002, March 14. A textile fiber is prepared from the copolymerization of a vinyl halide with a vinyl ester containing a butyl tin salt of lauric acid as a stabilizer.

# We would like to add our WHISPER

... by reprinting, over our signature, the complete advertisement of a fellow American manufacturer... and in so doing, add our plea for that unity of purpose which will change this whisper into a tumultuous shout.

12

## When Duty Whispers Low, "Thou Must!"

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THE four greatest nations of this earth are waging a life and death struggle with those forces of evil bent on the destruction of man's greatest treasure—freedom. Three times during this, the most devastating war of all time, destiny has tested, through fire and ordeal, three of the four champions of liberty.

Take China: the barbaric Japanese have all but destroyed her material wealth, not to forget for a moment the millions of Chinese who have been wantonly killed by land and air attack. Cities destroyed, huge parts of their homeland under the despot's heel, millions enslaved without benefit of aid or even comfort. China has withstood every trial—supreme in her hour of travail—hoping, praying and fighting. Truly destiny has marked ageless China as one of its very own.

Remember Dunkirk! Proud Britain almost at journey's end. Unarmed but unafraid, the miracle happened. 300,000 soldiers of the Empire brought home in the face of incredible odds, by the folks back home. And then, that immortal "Blood, Sweat and Tears" promise of the war's greatest symbol—Churchill. England looked squarely at the finger of destiny and through a unity unparalleled met the issue and in all her righteous wrath, rose to the pinnacle of her greatness.

Russia at Moscow! With the German hordes at the gates of the city, with large areas of her country conquered, her important cities in ruins, millions of her men dead or wounded, Russia dared to look at the finger of destiny pointed her way, and, by a united effort of her soldiers, her men and women—yes, even her children—saved Moscow and saved Russia. Never in the pages of history has greater courage been matched so nobly by sublime unity of purpose.

Each of our allies has had its ordeal, and in each instance has met and conquered when destiny placed their very existence in the balance.

But what about the greatest of these, America? Her sons and daughters have gone forth to do battle

in the cause of freedom. Their exploits, their valor, their courage, bring tears to the eye and exaltation to the soul. These fine young people—softies, as they were referred to by our enemies—have learned discipline, have mastered tactics, have forged a unity that gives notice to all of the stuff of which Democracy is made.

And now the hour of crisis is here! That hour when the finger of destiny points at us, at America. Will we, the greatest nation of all, meet our crisis as have our brave allies? Will we, soldier AND civilian, be united there on the beachheads of fortress Europe? The next hundred days will write history for a hundred years to come. Can a nation of free men, who enjoy free speech, forget petty things for these hundred days of crisis and UNITE in spirit and in fact to meet our great test? Can we forget that we are Democrats or Republicans, rich or poor, Jew or gentile, worker or manager—can we be Americans, united as never before in our glorious history? This is more than a battle for beachheads. This is the real test of a system of government that the world has been waiting for. Can we forget, during this short but crucial period, every thing but one—that we are United Americans? God grant us, ALL of us, the wisdom to see, the courage to bear and the unselfishness to unite in one glorious effort for our Country!

Destiny has saved us until last, and history will record these next hundred days as a period in which the final victory will have been achieved by circumstance or by a profound, unselfish unity. Can we meet this last great obstacle humbly, reverently and unafraid, but, most important of all, can we meet it?

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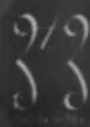
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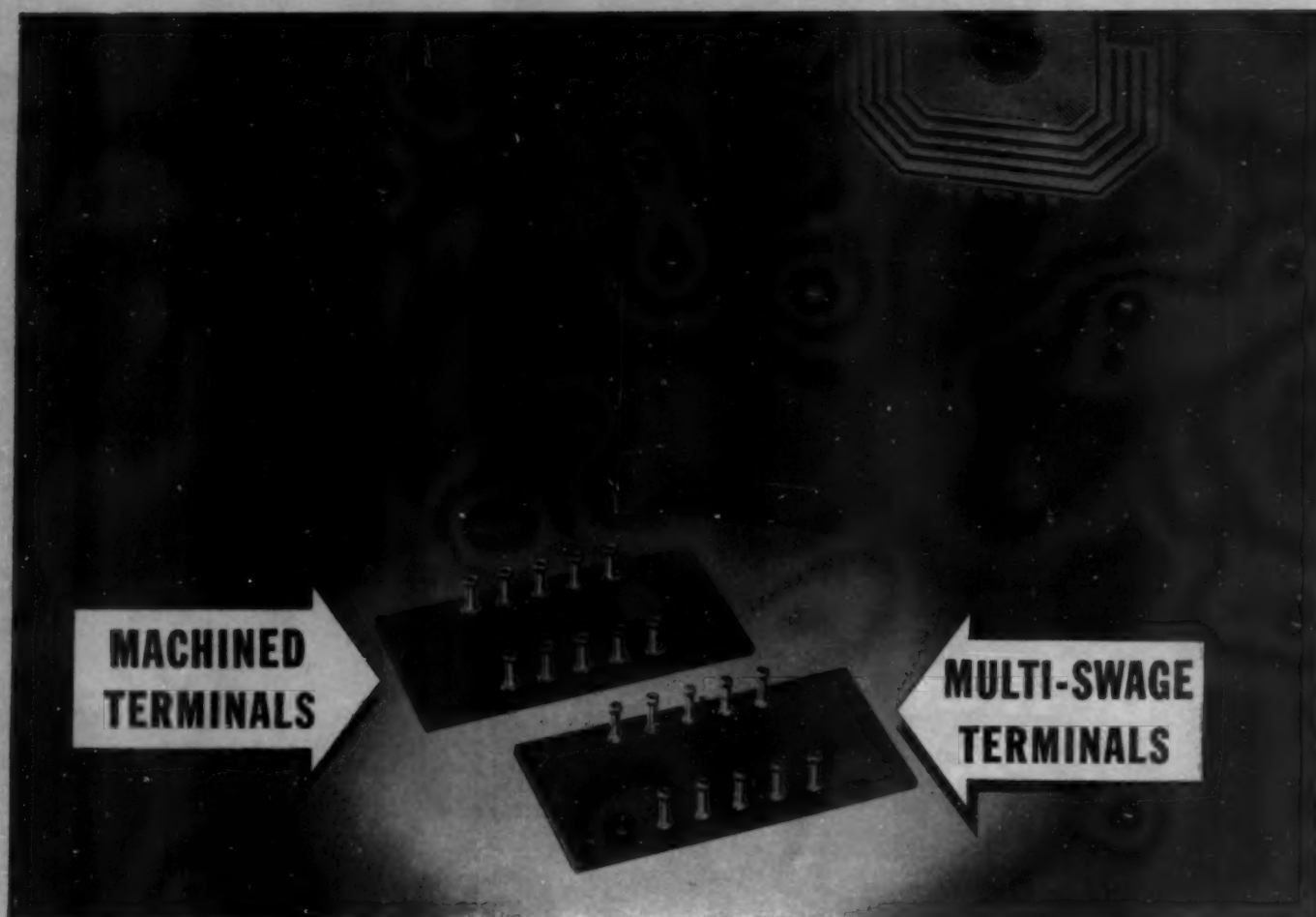
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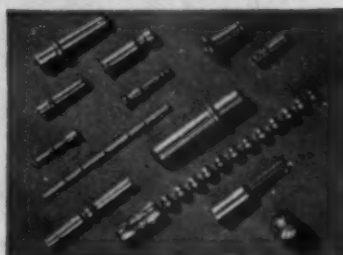
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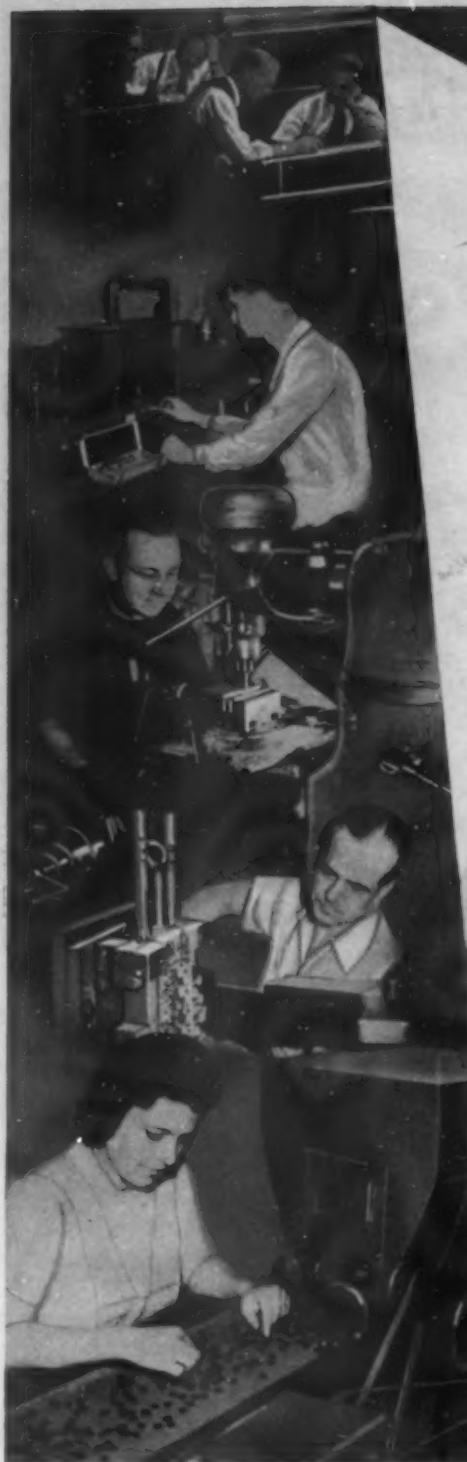


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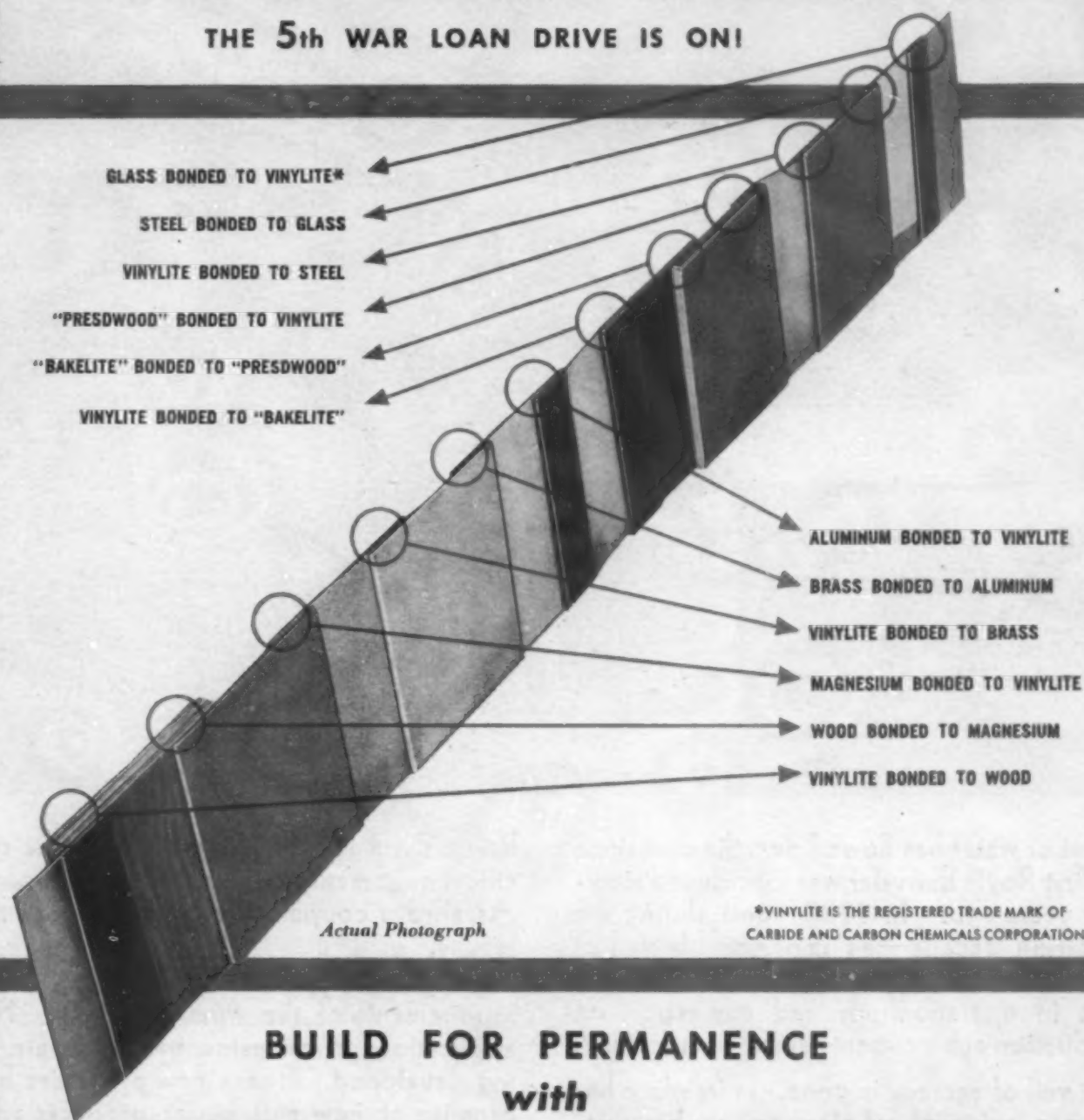
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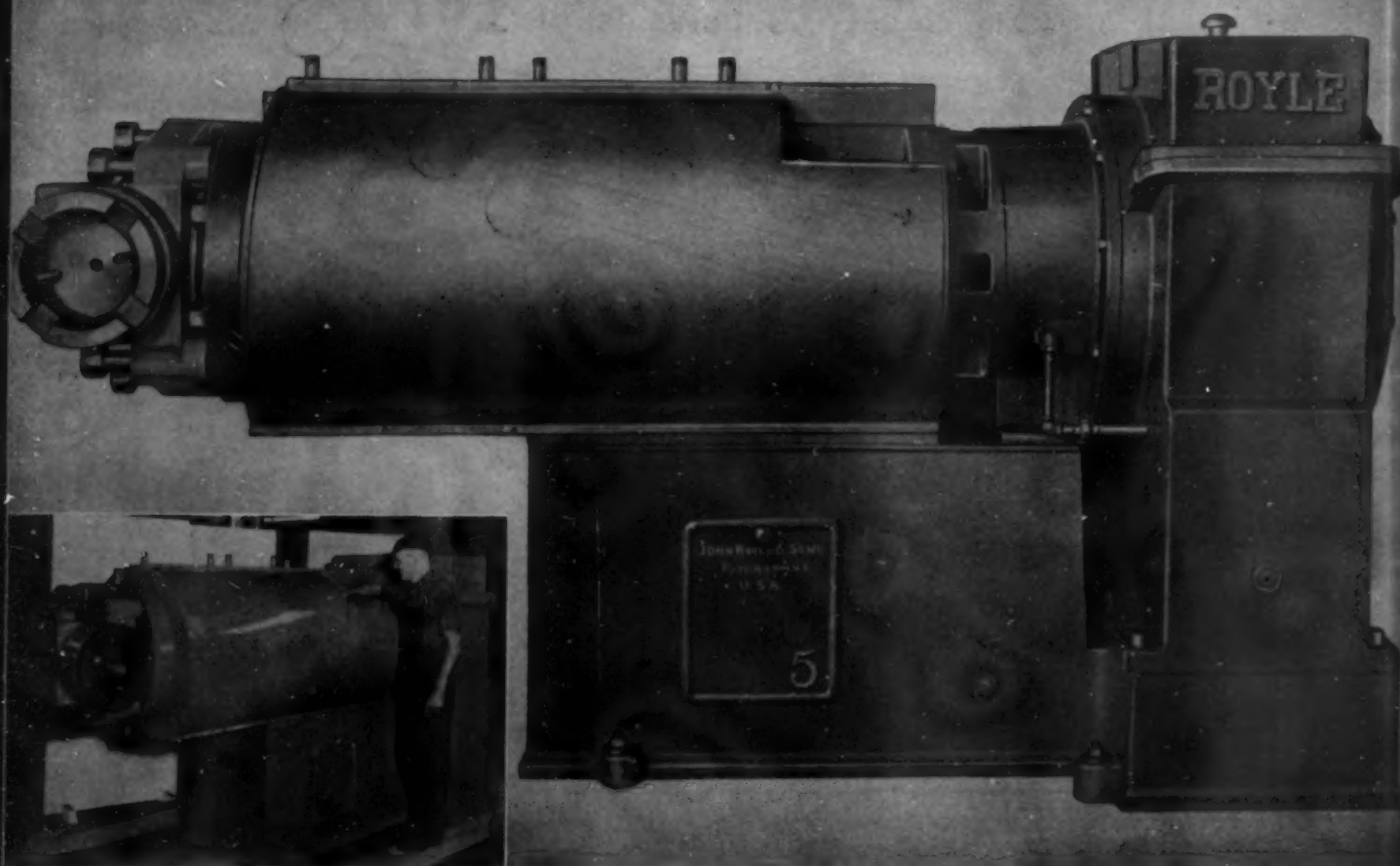
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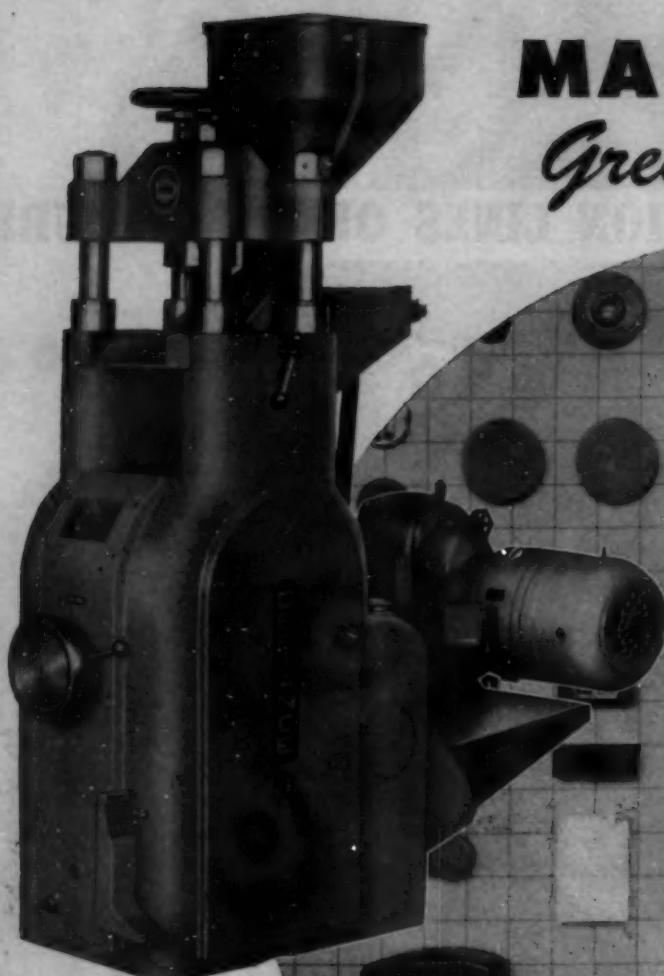
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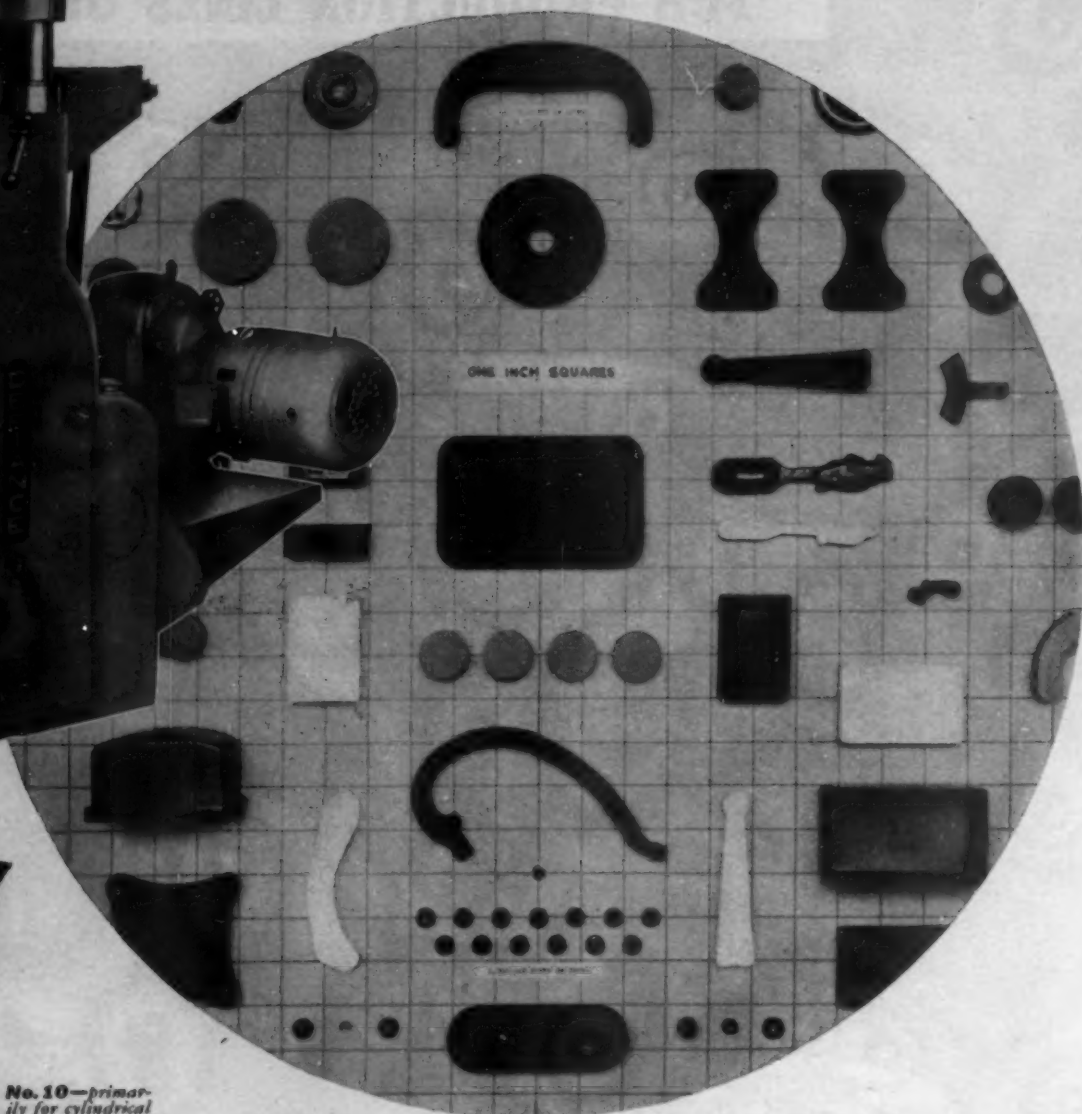
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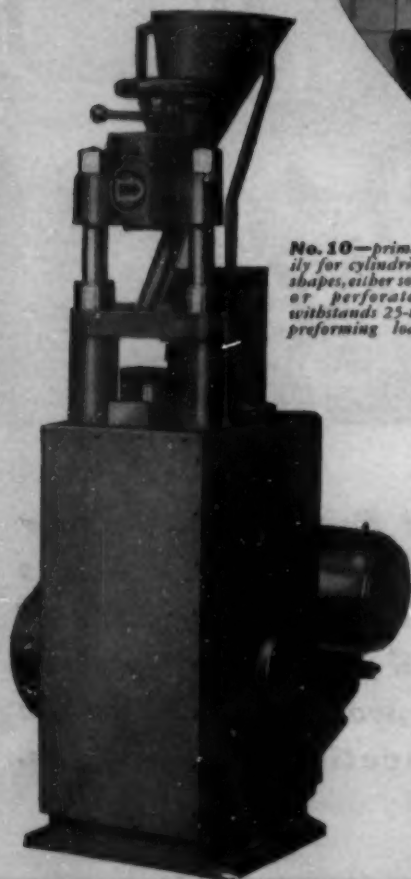
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## In the Laboratory TODAY... in production TOMORROW

In Emery's Laboratory are many new products. Among them are two which will be particularly interesting to the manufacturer of plastics.

A new process, developed and engineered by Emery, makes possible the commercial production of two acids... azelaic and pelargonic, and their derivatives. All of these have been comparatively unknown outside of the laboratory. One of these, a short chain dibasic aliphatic acid, reacts with monohydric alcohols to form relatively high boiling esters. It combines with glycerine and other polyhydric alcohols to form *soft* alkyd resins.

The other is a mixture of short chain, low molecular weight, monobasic aliphatic acids, in which pelargonic acid predominates. Its esters are, in general, more compatible with resins than esters of higher molecular weight acids. This suggests their application as plasticizers.

We realize that you will not order a carload of these new acids because of these comments... we couldn't ship it to you if you did. But if you are interested in the tests made by our laboratory on these new acids and esters, particularly with reference to low temperature plasticity, or if you would like to examine them in your own Research Department, just let us know.

In the near tomorrow, we will produce these on a large scale to supply you with new raw materials for better plastics.

### AZELAIC ACID $C_7H_{14}(COOH)_2$

Melting point	90°C.
Combining weight	93-95
Solubility (water)	∞ @ 100°C.
Solubility (alcohol)	slight @ 25°C.

### PELARGONIC ACID $C_9H_{17}COOH$

Melting point*	Below 0°C.
Combining weight	145-155
Solubility (water)	sparingly hot
Solubility (alcohol)	soluble

\*No exact freezing point has been run on these low molecular weight acids.



# EMERY INDUSTRIES • INC.

STEARIC ACID • OLEIC ACID • ANIMAL AND VEGETABLE FATTY ACIDS

4300 CAREW TOWER • CINCINNATI 2, OHIO

New York Office: 3002 Woolworth Building, New York City • New England Office: 187 Perry Street, Lowell, Mass.

# LIVINGSTON

## PLASTICS CORPORATION

The Progressive Name in Plastics

1431-35 Hubbard Street

Chicago 22, Illinois

Canal 6272

Plant No. 2—Northbrook, Illinois

New York Office, 171 Madison Ave.

New York 16, N. Y. Lexington 2-4715



A company whose scope  
of service is nation-wide,  
whose background goes  
deep into plastics history,  
who is equipped to mold,  
print and fabricate plas-  
tics for every industry  
both now and in the post-  
war period.

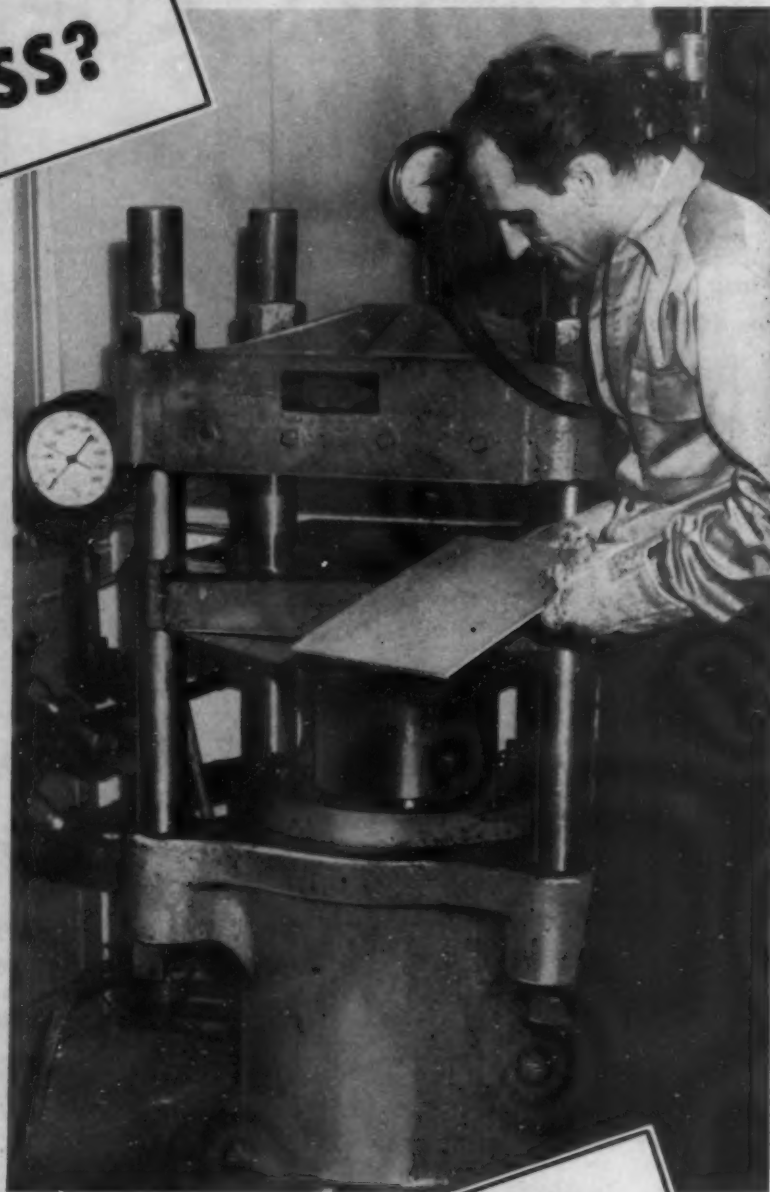
*"The Progressive Name in Plastics"*

## *What's Cooking* at **HUMMEL-ROSS?**

Hummel-Ross manufactures Kraft Board and Paper. 300 tons of it daily. War has brought countless new uses for our products. Many discovered through our own complete research and laboratory facilities. Today we are sparing no expense in laboratory research on the uses of our products for the post-war world.

Because plastics loom so large in tomorrow's schemes, we are tripling our laboratory facilities for research in the plastics field.

★ Laboratory experiment with plastic impregnated paper under heat and pressure.



## **Originators...Creators**

**HUMMEL-ROSS**  
**FIBRE CORPORATION**  
Hopewell, Virginia, U. S. A.



... For the men of vision who look ahead and plan the "Shape of Things to Come" . . . revolutionary Ideas today perhaps, but practical advancements tomorrow that will fill the essential needs of a rebuilding post-war world . . . New Ideas . . . New Purposes and Applications . . . New Products . . . and of basic prime importance, new materials with which to build them.

RESIN FIBRE PLASTICS possess the qualities that supply the answer as to what materials to use . . . for the problems of today, and an encouraging inspiration for the products yet buried in blueprints. In RESIN FIBRE PLASTICS you will find a plastic improved in diversified adaptability . . . high physical property values . . . pliability of formulation . . . the solution of difficult contours . . . All potentialities toward the ever-increasing usefulness of plastics . . . especially RESIN FIBRE PLASTICS. We will be glad to share our technical facilities with your problems . . . Write and tell us what they are. We will be happy to cooperate.

*Today an Idea . . . Tomorrow a Product*

LICENSING MANUFACTURERS

MOULDED FIBRE PRODUCTS  
**Hawley**  
RESIN FIBRE PLASTICS  
**PRODUCTS COMPANY**

ST. CHARLES  
ILLINOIS

BRANTFORD, CANADA • BUENOS AIRES, S. AMERICA  
LONDON, ENGLAND • SYDNEY, AUSTRALIA

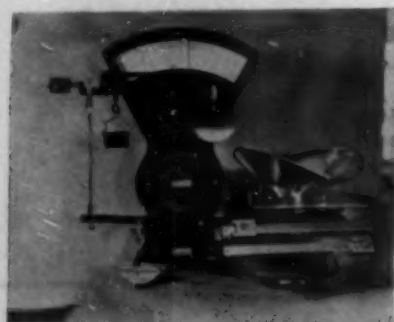
# NEW MACHINERY AND EQUIPMENT

★ **CHRONOTROLS, A LINE OF INSTRUMENTS** designed to enforce any desired heating or cooling program, have been introduced by Wheelco Instruments Co., Chicago, Ill. These instruments employ an electronic principle of effecting temperature control and provide completely automatic temperature regulation regardless of the changes in temperature required for a given process or application. Offered in 25 models, Chronotrols include 10 for proportioning control and others for 2-position "on-off" and 3-position "on-intermediate-off" control for high- and low-temperature applications.

★ **ONE OF THE LARGEST HYDRAULIC PRESSES** EVER built for powder metallurgy has been completed by Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Although designed for briquetting powdered carbides of tungsten, titanium or tantalum for carbide cutting tools, dies and inspection gages, the press is also suited to other powdered metal forming which requires the application of high pressure from 2 different points. It will exert a 1500-ton downward acting force and a 1000-ton horizontal acting force. It is completely self-contained, being equipped with 2 radial hydraulic pumps to generate the operating pressure. The pumps are connected to a 30-h.p. double-end-shaft electric motor. Operation is automatic with an electric pushbutton starter and automatic predetermined pressure reversal.

★ **IN COMBINATION, THE DOALL ELECTROMAGNETIC** chuck and the DoALL selectron, a new current rectifying and demagnetizing unit, are said to improve and ease difficult grinding operations, by bringing under the operator's control the amount of magnetic pull of the chuck holding the work to be ground. The selectron uses electronic power to control the flow of magnetic pull in the chuck and to demagnetize the chuck when the work is to be removed. The chucks are available in 2 sizes—the 6 × 18-in. size of 125 watts and the 8 × 24-in. of 175 watts—and both can be operated with either 110- or 220-volt d.c. input. The selectron is available in 120- or 220-volt a.c. input and 220-volt d. c. output, of 175 watts. Both chuck and selectron are manufactured by Continental Machines, Inc., Minneapolis, Minn.

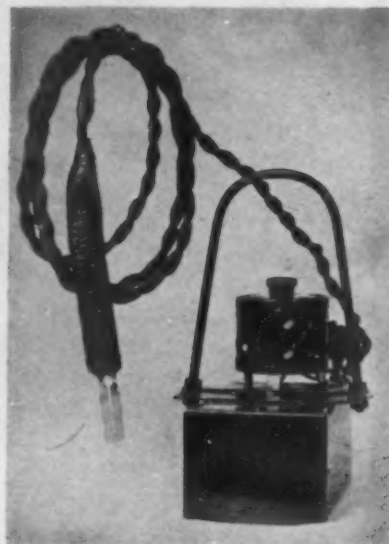
★ **NO RATIO CHARTS, REFERENCE TABLE, OR MENTAL** calculations are necessary for counting small parts when the new double ratio scale, Type 1133-C, offered by Howe Scale Co., Rutland Vt., is used. It is said to be especially adapted for this work because of the unusually high sensitivity provided by a third pan attached to the lower beam lever. This is designed for use with the high ratio pan only and provides a ratio of



10:1 between the two pans, the sensitivity of this combination being more than ten times greater than that between the platform and the regular 10:1 pan. These scales are obtainable from Howe in two regular ratio combinations: 100:1—10:1—10:1, and 99:1—9:1—9:1. On special order other ratios can be supplied. They have a total counting capacity of 40 lb. and a

total weighing capacity provided by two beams of 20 lb. × 1 ounce. A target-type flush indicator is claimed to eliminate parallax and provide easy "over and under" determination. The platform measures 8<sup>3</sup>/<sub>4</sub> in. in diameter and is beaded to hold a scoop 19<sup>1</sup>/<sub>2</sub> by 10 by 6 inches. Over-all height and length of this scale are 27 in. and over-all width is 15 inches.

★ **A NEW VOLTAGE HOT KNIFE FOR CUTTING AND** trimming rubber substitutes is being manufactured by Sta-Warm Electric Co., Ravenna, Ohio. This knife can be used like a putty knife in welding or forming a bond on synthetic rubber coated wires. When heated, it can be readily formed to any



curvature without rupture. The blade metal which has an efficient length of about 2<sup>1</sup>/<sub>2</sub> in. is very tough and can be sharpened to a cutting edge. The knife is operated from 100 Va.c. 60 cycle current supply drawing 250 watts maximum. Blade temperature is controlled from approximately 250 to 1200° F. by means of a rheostat having 150 steps of control. As its capacity is somewhat limited, the knife should not be used for cutting through heavy masses of cold material, but for trimming or intermittent work which will not dissipate the generated heat too rapidly.

★ **ACCORDING TO ITS MAKERS, KNU-VISE, INC.,** Detroit, Mich., the redesigned Knu-Vise toggle-action clamp, Model KP 830, is the strongest clamp of its size on the market. When closed, the clamp assumes a horizontal position and both bar and handle are in a straight line, close to the working level. The resultant overhead clearance permits movement of work. The vertical spindle is located in a U-shaped bar or channel for positioning in a horizontal direction to suit the particular job. The clamp measures 4<sup>3</sup>/<sub>4</sub> in. in over-all length, and 1<sup>5</sup>/<sub>8</sub> in. in height when closed.

★ **A FLEXIBLE SANDING PAD WHICH CAN BE DE-** tached from the machine simply by pulling out a latch is an outstanding feature of the new Sterling 1000 electric portable sander, manufactured by Sterling Tool Products Co., Chicago, Ill. Especially designed to cover the entire range of abrading from coarse sanding to lapping and finishing, this sander is said to provide fast, precise, uniform cutting on wood, metal and plastic. The flexible sanding pads are intended to conform to convex or concave surfaces of moderate curvature, and special pads for unusual contour sanding or rubbing are also available.

# For War Production and Post-War Competition

# Mold Automatically

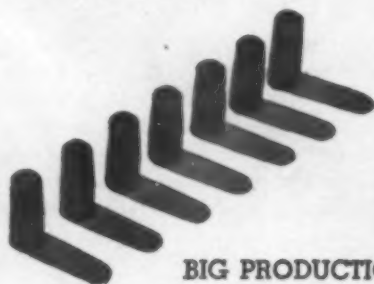
## INTRICATE MOLDINGS...



LARGE SIZE  
MOLDINGS

This Minneapolis-Honeywell thermostat cover is a good example of large work, re-designed for Automatic Molding.

Production was speeded up. Parts are identical, uniform, accurate... require less finishing, cost considerably less to produce.



BIG PRODUCTION  
LOW COST

Esterbrook Pen Co. formerly purchased these little caps. Rejects and inaccuracies were a problem. An investment of \$7,000 for Stokes Automatic Molding Machines and molds is saving this company an approximate \$11,000 per year in the cost of these moldings.

**WAR-PROVED** through the production of thousands of different plastics parts to the most exacting government specifications — the Stokes Completely Automatic Molding Machine offers post-war economies no executive can afford to overlook.

For it permits him to make the plastics parts he needs, as he needs them, right in his own plant by a completely automatic method requiring only a minimum of skilled labor, and at savings which many times have paid for the entire investment in a matter of months.

## AUTOMATIC MOLDING SAVES

Automatic Molding saves labor... machines are completely automatic.

Molding time is saved... cycles are reduced 50% or more in many cases.

Molding material is saved... 8% to 10% or more.

Mold cost is low... only few cavities are used.

Tool steel and tool-makers' time are saved... molds require only a fraction of

the steel and labor that go into a large conventional mold.

Output per cavity is high... up to 10,000 or more moldings per week.

Parts are produced as needed. There are no large inventories, therefore... no inventory losses.

There are no human errors to contend with... parts are of highest quality, always.

## LET US MAKE A COST STUDY FOR YOU

It is none too soon to investigate Automatic Molding for many parts that will go into your post-war products. Stokes engineers who pioneered Automatic Molding have helped many manufacturers apply it to the solution of their individual problems.

Use this special Consulting Service... to tell you quickly whether parts are suitable for automatic molding, to accurately estimate costs, and to help you in automatic mold design.

## F. J. STOKES MACHINE COMPANY

6032 Tabor Road Olney P. O. Philadelphia 20, Pa.

Representatives in New York, Chicago, Cincinnati, St. Louis  
Pacific Coast Representatives • L. H. Butcher Company, Inc.



Stokes Completely Automatic Molding Machine. Model 200-D, 15 tons capacity. Entirely self-contained, electrically heated and powered.



Stokes "Standard" Semi-Automatic Press. 150 tons capacity. Complete with automatic time-cycle control, power-unit housing and "Slow-Close" device. One of six models from 20 to 300 tons capacity.

# F.J. Stokes

## MOLDING EQUIPMENT



# BOOKS AND BOOKLETS

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent post-paid at the publishers' advertised prices.

## Toxicology and Hygiene of Industrial Solvents

edited by K. B. Lehmann and F. Flury

translated by Eleanor King and Henry F. Smyth, Jr.

The Williams and Wilkins Co., Baltimore, Md.

Price \$5.00

373 pages

This translation of a German text is a valuable contribution to the protection of workers from the toxic effects of solvents. The original studies were based on investigations made in the Hygienic and Pharmacological Institutes of the University of Würzburg, the industrial-hygienic laboratory of the I. G. Farbenindustrie and the Dermatological Clinic of the University of Breslau. The chemistry, preparation and use of solvents, methods of chemical analysis, the toxicology of solvents and various protective measures are discussed. Detailed consideration is given to each of the principal solvent groups.

## Encyclopedia of Substitutes and Synthetics

edited by Morris D. Schoengold

Philosophical Library, Inc., 15 East 40th St., New York

Price \$10.00

382 pages

The editor has compiled an encyclopedia of the various products now used as replacements for materials which are either difficult or impossible to obtain under wartime conditions. Following the description of each item are listed some of its physical and chemical properties, its principal uses and alternate substitutes. The back of the book contains a comprehensive index of trade names.

★ **TENSILE TESTING INSTRUMENTS MANUFACTURED** by W. C. Dillon and Co., Inc., Chicago, Ill., are described in Bulletin No. 141. Special attention is given to the company's new portable tensile tester, a small machine which is said to contain all the desirable features found in regular testers, and to have many additional outstanding qualities.

★ **AN 8-PAGE BULLETIN DESCRIBING FARREL** manger couplings is the latest publication to be released by Farrel-Birmingham Co., Inc., Ansonia, Conn. Designed for applications where space limitations make a close-coupled connection necessary or desirable, these couplings are said to provide complete flexibility between driving and driven units by means of a flange which can be bolted directly to a flywheel, brake drum or similar component. Included in the brochure are engineering details, application diagrams and tables of sizes, ratings and dimensions.

★ **CATALOG NO. 44 OF THE WETMORE REAMER CO.**, Milwaukee, Wis., describes the construction and use of the company's reamers and boring bars. A series of photographs, line drawings and elaborate test data charts supplements the text and gives additional interest to the booklet.

★ **TWO POPULAR CARBON STEEL PRODUCTS BEARING** the patent of W. J. Holliday & Co., Hammond, Ind., are pictorially and textually analyzed in a bulletin approximating a scientific treatise in content. Speed Case—a low-carbon, open-hearth, free machining steel—and Speed Treat—a medium carbon, open hearth, high tensile, free machining steel—are presented with a wealth of tables, charts and illustrations to substantiate the claims made by the maker. A reasoned discussion of their uses is also included.

★ **VARIOUS PRODUCTS IN ACTUAL USE IN FINISHING** a variety of items from huge ship propellers to the smallest machine part are shown photographically in a new manual issued by Minnesota Mining & Manufacturing Co., St. Paul, Minn., entitled "3-M Abrasive Specialty Items." Included are the latest types of abrasive shapes and forms that have been devised for grinding and finishing metal into belts, evenrun bands, cones, sleeves, cartridge rolls, overlap slotted disks, slotted disks, pyramid disks and numerous other forms.

★ **"HOPP PLASTICS—TODAY AND TOMORROW,"** JUST issued by Hopp Press, Inc., New York, N. Y., details the company's service, facilities and progress in the plastics field in the past 51 years. The general properties of the plastics fabricated by this company are presented in the form of a comprehensive and readable table.

★ **TO FURNISH BUSINESS AND GOVERNMENTAL** executives with a means of acquiring information about the scope of activities of independent laboratories and the advantages to be derived from utilizing their services in the solution of scientific, engineering, testing and inspection problems, the American Council of Commercial Laboratories has published a directory of all such laboratories listing in detail their organizations, services and specialties. Copies of the booklet may be obtained from the executive secretary, A. J. Nydick, 63 Wall St., New York 5, N. Y.

★ **CONDENSED INFORMATION ON COATED ABRASIVES** and oilstones is presented in the latest B-M Bulletin to be published by Behr-Manning (Division of Norton Co.), Troy, N. Y. The advantages and limitations of an "idler backstand" are listed, and interesting photographs are included to clarify the textual matter.

★ **"SHAPING TOMORROW—TODAY,"** A COLORFUL brochure published by Midland Die & Engraving Co., Chicago, Ill., gives a thorough account of the work carried on in the plant and shows examples of the more complicated molds constructed by the company. Text and pictures combine to give the reader a thorough understanding of the many steps involved in the construction of molds or dies and the company's facilities to carry out this work.

★ **DELTA MANUFACTURING CO., MILWAUKEE, WIS.,** presents case histories of 140 special-purpose machines in a new 76-page "Blue Book" for management, shop and production engineers. These ingenious designs which employ standard Delta drill press heads, columns and other tools are reported to have increased production in many instances as much as 200 to 600 percent without the expense and delay of creating large costly special machines which would be useful only for a given operation. The examples cover a wide variety of operations on metals, plastics and wood.

★ **MAGNETIC CHUCKS, ETCHERS, DEMAGNETIZERS** and tachometers manufactured by Ideal Commutator Dresser Co., Sycamore, Ill., are detailed and their applications fully explained in a new booklet issued by this firm. The machines are pictured in actual use with line drawings and charts to supplement information given in the text.

WASHINGTON  
THE FUTURE IS A MATTER OF DIRECTION



*Molders of Plastics*

**GENERAL MOLDED PRODUCTS • INC**

GENERAL OFFICE AND PLANT

DES PLAINES • ILLINOIS

JUNE • 1944

151

# WASHINGTON ROUND-UP

R. L. VAN BOSKIRK, Washington Editor

## "Swimming in phenol?"

WPB officials are disturbed over "loose" statements concerning the phenol situation. They will admit that the reserve tanks and vats are full of phenol, that present facilities are not being used to full capacity and that several plants have even ceased production. However, many persons simply refuse to recognize the danger in the benzol situation. Benzol is still extremely tight and without benzol there can be no phenol. Phenol is being allocated 100 percent for many plastics requests that can show a good utilitarian end use. While none is being allowed for such things as buttons or cosmetic containers, closures, for example, are getting around 1,500,000 lb. a month. Whatever is drawn from the stockpile is immediately replaced.

WPB has no intention of getting caught short again. Enough benzol can be obtained to replace quickly every pound of phenol that is used for allocated plastic end uses. That is all the benzol that can be used for plastics today. Within a few months' time, it is quite possible that the benzol situation will change for the better. New processes may eliminate the need for the use of such quantities of benzol in the production of aviation gasoline. When that time comes, more benzol will be available for more phenol. But until that time comes, WPB is going to maintain its present phenol stockpile since no one knows when some sudden military need may make exacting demands.

One other factor ought to be kept in mind—any large demand for phenol might put a crimp in the formaldehyde situation because there would not be enough of this latter material to match the phenol which is available. If some time in the future the supply picture looks relieved and adequate to the point where controls may be relaxed, WPB officials have stated that the present control of these commodities will be revoked.

## Inventory aches

There is still some confusion over inventory reporting under the new cellulose acetate order M-326-b. In reporting inventory on Table II of WPB Form 2945, the following listings will meet WPB requirements:

1. List the combined total of all virgin cellulose acetate and cellulose acetate butyrate molding powder on hand.
2. List the total of all scrap acetate and butyrate molding powder on hand.

If scrap is sold to a supplier, report this in Table II in the form of a statement. "Grade" does not mean a color or a formulation nor does it mean that each supplier's product or formulation must have a separate grade. The only grades are as follows:

Acetate	Butyrate
Color	Color
Reworked	Reworked
Scrap	Scrap

If a molder wishes to dispose of excess or scrap molding powders he may proceed according to one of the 3 following procedures which may be adapted to allocation orders M-246, M-331, M-170-a and M-326-b, as quoted from a letter which was prepared by WPB officials:

1. Pursuant to Priorities Regulation No. 13, the material may be sold to a supplier without further authorization; or
2. If a molder wishes to use material from inventory, he should file Forms WPB-2945 stating the proposed quantity and end use and, in the space provided for supplier's name, enter "from inventory." If the material was authorized for another end use, give a brief statement as to why this authorized end use was not fulfilled; or
3. If molder should desire to sell excess or scrap molding

powder to Molder A, Molder A should file forms WPB-2945 and name Molder B as supplier. A letter from Molder B should accompany Molder A's application stating his willingness to transfer this material, as well as reasons for not using the material for the end use originally authorized.

**Important**—Unless a military urgency is involved, applications will not be processed except at regular allocation periods. Consult the governing allocation orders for filing dates or for any further information on the matter.

## Plastic canteen contracts are cancelled

The highly publicized ethyl cellulose canteen for soldiers has gone out of production. Its history is a lesson in plastics application and a subject for serious consideration by every person in the industry.

It did a fine job as a replacement. Aluminum was tight—the plastic canteen filled in when canteens were sorely needed—and all honor is due to the producers, processors and procurement officers who came through in a pinch. Its limitations were recognized from the start. But it was lighter than metal and met practically every requirement except for the fact that it would melt when held over a flame. Insofar as cost was concerned it was a few cents less than aluminum. Its lightness and translucence which made it possible for a soldier to see how much water he had, gave it certain advantages over aluminum.

The plastic canteen contract was officially cancelled for these reasons: 1) Aluminum and facilities to produce aluminum canteens became available. 2) The plastic canteen could not be heated over a flame to melt the inside contents after freezing. 3) The plastic canteen was never standard—it was always a substitute standard and Army regulations provided that standard items be procured whenever possible.

The lesson for all plastics minded persons should be obvious. Plastics applications should be retained whenever possible where they will do a better job than anything else. This is no criticism of the canteen experiment for it proved most useful in a wartime pinch. Just the same it is an outstanding example of what should not be done in normal times. There are many examples similar to this in wartime, but leaders in the industry are most hopeful that the idea will not be carried over into peacetime. They are constantly mindful of the fact that when a person has seen a plastics failure he is scornful of all plastics regardless of the circumstances that may have attended his own experience with a single type of these materials.

Cancellation of this contract left several thousand pounds of molding powder in the hands of contractors. The problem of disposing of it for a useful end product was a difficult task for WPB. There wasn't enough in any one contractor's hands to make much of a dent in production of any other war goods items, and if the material were used for non-essential goods there would be criticism. Even if it were possible to move it all into one plant, there would be charges of discrimination. This is one of the kind of problems that cancellation is going to bring to the industry. It will take patience on the part of both industry and WPB to iron them out. Incidentally the amount of ethyl cellulose molding powder going into canteens was not enough to make any difference in its availability at this time.

## Cotton duck on allocation again

Cotton duck went back on allocation on April 7 under the terms of an amendment to M-91. Laminators who use great quantities of this material may now breathe easier for they are more likely to get their needed material under allocation than they were when it was free.

# OLSEN-BAKELITE PLASTIC FLOW TESTER



## The Recognized Standard for Laboratory Testing and Production Control

The Olsen-Bakelite Flow Tester was developed for use on thermo-plastic and thermo-setting materials. It has found increasing usage in the plastics industry because of the wide variety of materials which fall in one or the other of these classifications — all of which must be accurately rated in order to assure uniformity and efficiency in production.

### What the Olsen-Bakelite Flow Tester Does:

1. Provides for controlling and varying the temperature as it is being applied to the material being tested.
2. Provides for application of pressure in units of 100 lbs. per square inch up to 3,000 lbs. per square inch.
3. Determines the plasticity properties while these changing conditions are taking place.
4. Assures an accurate means of observing and recording the results of such changes. For this purpose an automatic recording device is furnished.
5. Thus the machine plots the flow of the material against time.

If you have not already received your copy of Bulletin 23, giving details of the complete line of Olsen Plastics Testing Equipment, write today on your company letterhead and a copy will be sent to you by return mail.

Proving every day that the value of testing depends on the quality of the testing equipment.



**TINIUS OLSEN TESTING MACHINE CO.**

580 NORTH TWELFTH ST., PHILADELPHIA 23, PA.

Representatives: PACIFIC SCIENTIFIC CO.

Los Angeles, San Francisco, Seattle

Mine & Smelter Supply Co., Denver, Colo.

PHYSICAL TESTING EQUIPMENT • BALANCING MACHINES

# NEWS OF THE INDUSTRY



JOHN C. BROOKS



FELIX N. WILLIAMS

★ **JOHN C. BROOKS, VICE-PRESIDENT AND DIRECTOR** of Monsanto Chemical Co. and general manager of its Plastics Division, died suddenly on April 26 at the age of 58. Mr. Brooks was succeeded as general manager by Felix N. Williams, who was formerly the production manager of the company's Phosphate Division.

★ **DR. WILLARD HENRY DOW, PRESIDENT OF DOW Chemical Co.,** Midland, Mich., has been selected to receive the Gold Medal Award of the American Institute of Chemists for the year 1944.

The Dow Chemical Co. has opened a new office in Detroit, Mich., bringing their total of offices throughout the country to twelve. Walter J. Truettner will head the office while Ralph B. Ehlers will be in charge of magnesium distribution, Paul M. Jensen in charge of plastics and Fielding H. Yost, Jr., in charge of industrial chemicals and pharmaceuticals.

W. R. Dixon has been appointed assistant manager of the plastics engineering division of the company. Mr. Dixon has been with the organization since 1936 and handled many wartime plastic projects.

★ **CONTINENTAL CAN CO., INC., HAS APPOINTED** Cecil W. Armstrong chief development engineer of its Plastics Division. Formerly Mr. Armstrong was senior research engineer of Lockheed Aircraft Corp., and chief engineer of Marco Chemicals, Inc.

★ **AMERICAN CYANAMID CO., NEW YORK CITY,** announces the following changes in its Plastics Division: Carl H. Pottenger has been named assistant sales manager; Walter N. Finney, head of technical service staff and W. H. MacHale, supervisor of Trade Records in addition to his present duties as advertising manager.

★ **NEWLY-ELECTED CHAIRMAN OF THE BOARD OF Directors of Thiokol Corp.,** Trenton, N. J., is Dr. J. C. Patrick. Other new officers are: J. W. Crosby, vice-president and general manager; H. R. Ferguson, vice-president; Edward P. Roll, Jr., treasurer and Dr. S. M. Martin, Jr., secretary. The present Board of Directors was reelected with Dr. C. Emmett Reid filling the vacancy caused by the death of Bevis Longstreth.

★ **C. G. GRESS HAS BEEN APPOINTED SALES MANAGER** of the Resinox Department, Plastics Div., Monsanto Chemical Company. Mr. Gress, formerly manager of the Detroit branch office of the Plastics Division, will be succeeded by Carl Whitlock, member of the Technical Service Department, Plastics Division.

★ **JOHN F. CORWIN HAS BEEN APPOINTED CHEMICAL director** of the Casein Co. of America. Former head of the OPA's Resins and Plastics Section, Dr. Corwin has recently been associated with the Plastics Division of American Cyanamid Co.

★ **THE NEW YORK OFFICE OF FARREL-BIRMINGHAM Co., Inc.,** Ansonia, Conn., is moving from 79 Wall St. to 3700 Chrysler Building. Albert P. Leonard will become manager succeeding Edward S. Coe, Jr., who has been transferred to the main office.

★ **AFTER A BRIEF VACATION FOLLOWING HIS RESIGNATION** as chief rayon consultant of OPA, Truman P. Handy has assumed his duties as a vice-president of Celanese Celluloid Corp.

★ **THE PLASTIC PRODUCTION, MACHINE SHOP,** tool and die making machinery and unfilled contracts of B. M. Bodde have been purchased by Plastic Manufacturing Co. of California, Los Angeles, Calif. Dewey W. Alm, former president of Plas-Tex Corp., has been appointed general manager.



CHARLES FREDERICK BURROUGHS

★ **ON APRIL 21 AT MAPLEWOOD, N. J., CHARLES Frederick Burroughs,** president of Burroughs Engineering Co. and a pioneer in plastics engineering, died at the age of 71.

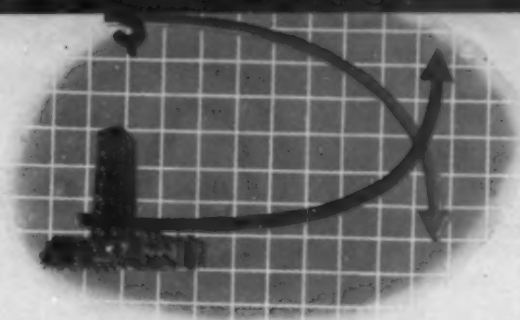
★ **M. W. REECE HAS BEEN MADE VICE-PRESIDENT** in charge of Pacific Coast operations of Reichhold Chemicals, Inc., Detroit, Mich. His duties will include supervision of branch offices in Los Angeles and Seattle.

★ **THE DETROIT PLANT OF CONSOLIDATED PAPER Co.** has been purchased by Detroit Wax Paper Co., River Rouge, Mich., to provide for the expansion of the company's plastics division.

★ **RALPH R. BROWNING AND PAUL P. HUFFARD,** vice-presidents of Union Carbide and Carbon Corp., New York City, and Homer A. Holt have been elected to the Board of Directors of that corporation.

★ **ON APRIL 19 CHICAGO MOLDED PRODUCTS CORP.,** Chicago, Ill., completed a quarter century of service in the field of molded plastics. Founded in 1919, this corporation has built molds for, and molded many "firsts," including the plastic washing machine agitators, plastic radio cabinets and one-piece antenna masts for airplanes. At present, facilities are devoted entirely to essential war applications.

★ **ANNOUNCEMENT HAS BEEN MADE OF THE ACQUISITION** by the Continental Can Co., Inc., of the Reynolds Molded Plastics Division of Reynolds Spring Co. There will be no change in personnel or policies of the new division.



# Production up—Price down Reason enough to plan on Styron

Add all the other well-known advantages of polystyrene and you get a clear picture of Styron's place in plastics



The individual qualities of Styron (Dow polystyrene) are well known. One reason for this recognition is the surprisingly wide variety of products that are made possible, or made better, by the use of these qualities.

In the fluorescent-light fixture shown above, as one example, Styron's exceptional clarity and high refractive index are peculiarly valuable. Its unique dimensional stability under extremely low temperature, its freedom from odor and its complete lack of water absorption are but a few of the properties which account for its success in the refrigeration field. The brilliant crystalline beauty of

Styron, its resistance to acids and alkalis, and the ease of its moldability make it both decorative and practical for use in products for the home.

Now, to polystyrene's own characteristics and versatility can be added the advantage of huge war-keyed production. As a result, Dow, pioneer and major producer of this outstanding thermoplastic, has been able to reduce substantially the base price—a trend of vast significance to the plastics industry. These facts are reason enough to plan on Styron.

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**DOW PLASTICS INCLUDE—Styron, Saran, Ethocel, Saran Film and Ethocel Sheeting**

# STYRON

(DOW POLYSTYRENE)



## Sculptured restorations

(Continued from page 94) Exact blending of the skin color and application of an invisible fastening material for the mask where it joined the face resulted in a prosthesis which suggested nothing more than an old scar. The adhesive which was developed by Mr. Edwards is made from a resinous gum dissolved in spirits. An oil ingredient preserves elasticity.

Through this method of restorations the utmost in the mechanical ability of the damaged bone structures is salvaged. Brace makers confronted with an unusual fitting problem are often at a loss to obtain maximum effectiveness with conventional methods. On the other hand, Mr. Edwards feels that the ability of doctors to save a weight bearing heel, as in the case of a crushed foot, is a godsend since the heel has no substitute in the field of mechanical appliances. In the restoration of fingers and toes the molds are smaller but the process of creating life-like restorations is basically the same as in the cases previously described. In these instances nails of cellulose acetate are added, the nails being held in place by a commonly used glue.

Where an ear or a nose is involved in the prosthesis the im-

PHOTOS, COURTESY BEAVER EDWARDS



5



6

pressions are taken in moulage. A molding compound with an agar base is employed since this material is less apt to cause irritation than plaster of Paris. From the moulage impression a model is shaped in plastilene, and the process of casting goes on as in the case of larger restorations. In the restoration of ears Beaver Edwards achieves a lifelike effect by inserting in the cast a foundation of thin dental acrylic which simulates the cartilaginous structure of the ear.

Since coloration is such an important factor in all restorations a great deal of experimentation has gone into development of a satisfactory medium. The material now in use consists of a mixture of waterproof pigments in a medium in which the plastic material of the restoration is solvent. Experience has shown that this mixture provides penetration of color upon application and insures adherence to a degree where the prosthesis can be washed with soap and water.

Though plastic materials have been used to a limited degree in connection with the prosthesis of structural members, Mr. Edwards believes that the fullest possibilities of this application of plastics have not been realized. A brief description of the method employed in mechanical restorations lends point to this belief.

Where it is necessary to replace an arm, a leg or a major section, the conventional method has been to use a carved wooden shell to duplicate the contour of the missing member. English willow has been most commonly used for this restoration because of its light weight. The usual procedure is to measure the normal arm or leg and then to duplicate the outside measurements in the willow blank. A hole as large as the outline will permit is bored through the blank and the long laborious task of shaping and carving begins. Skilled artisans chisel away with infinite patience at the interior of the wooden "arm" to make it as light as possible and to permit the installation of whatever mechanical devices are required for functional operation.

One of the interesting features of Beaver Edwards' work is his library of plaster molds. All casts are catalogued and identified in exact detail which covers the history of the individual case. Since the malformations and abbreviations are plainly indicated on the molds, replacement of restorations can be made quickly in the event of loss or damage.

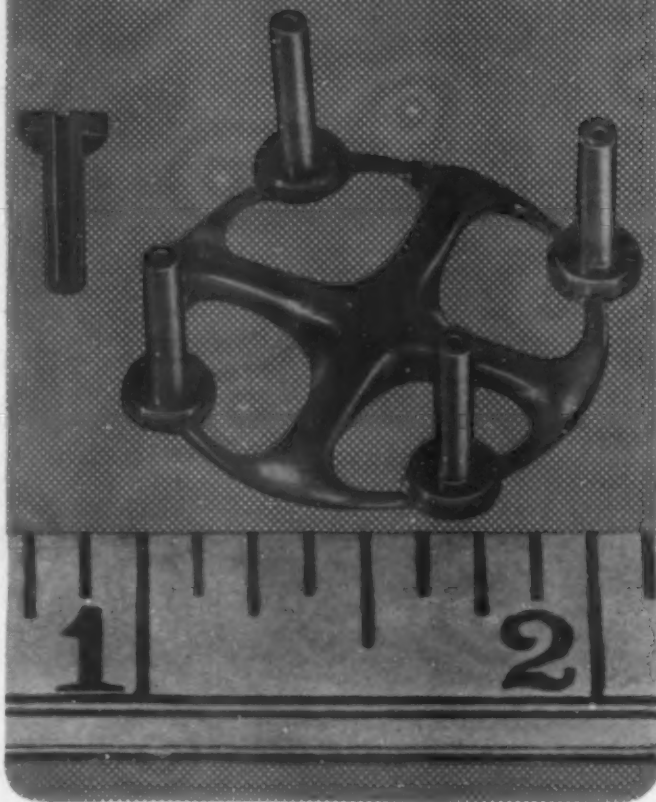
Now that the wounded from world battlefronts are beginning to be restored to civilian life, the demand for restorations is increasing tremendously. Though no one ever becomes entirely resigned to an abbreviation or malformation, medical men say that young men who have been wounded in battle are more sensitive to a physical shortcoming than those who have had time to make the inevitable mental readjustments. So that veterans leaving the service and reentering civilian life may be spared as far as possible the self-conceived odium of cripple, Mr. Edwards is attempting to provide life-like restorations with a minimum of delay.

This need spurs the search for more suitable materials which will fulfill the peculiar requirements of prosthesis. There is one drawback in Beaver Edwards' method which has not yet been overcome. This problem involves solvents. Though the present plastic hands and feet are impervious to soap and water, they will melt or mar if brought in contact with benzol, gasoline or any of that family of substances.

5—Left to right: The patient's shoe, the plastic foot and a model of the malformed foot from which the plastic mold was cast. 6—Right, a maimed hand. Upper left, sculptured restorations of the missing members. Lower left, the completed prosthesis ready for placement

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ADVERTISEMENTS ON TRANSFER MOLDING

# SMALL OPENINGS



Openings so tiny that they cannot be easily photographed are molded right in by TRANSFER MOLDING. For instance, the small pin illustrated (right) contains a precise amount of phenolic material. It is molded, four at a time on a single sprue. Embedded in the resin is a tiny hole, running vertically through the piece, of precise dimensions. This hole was molded in without any drilling or other finishing operations.

The molding of small holes and undercuts, too tiny to be formed any other way on a mass-production basis, is accomplished through TRANSFER MOLDING. This, another of TRANSFER'S advantages, is further explanation of the steadily increasing utilization of this process for molding thermosetting plastics.

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- on thermosetting plastics.

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# Environmental conditions

(Continued from page 126)

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Used in the manufacture of phenolic resins and as a solvent for resin coatings.

### *Dylenols*

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### *Benzene*

Used in the manufacture of styrene for plastics, as well as for synthetic rubber. Also used in the manufacture of nylon, rubber anti-oxidants, vulcanization accelerators, and in the manufacture of aniline for aniline-formaldehyde resins. It is the raw material for synthetic phenol.

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Used in rubber anti-oxidants, and vulcanization accelerators, and as a lacquer diluent.

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Used in the manufacture of rubber anti-oxidants, vulcanization accelerators, and in the manufacture of phthalic anhydride, the source of alkyd resins.

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- <sup>131</sup> "Effects of Low Temperatures on Neoprene Vulcanizates," by F. L. Yersley and D. F. Fraser, *Ind. Eng. Chem.* 34, 332-6 (1942).

## Heatronic molding

(Continued from page 113) tions. This may be demonstrated by the results obtained in the molding of 6 in. by 6 in. by 2 3/4-in. thick blocks. A careful study was made of the variations in physical and mechanical properties through the width and thickness of such blocks molded by both the standard and heatronic process from cellulose-filled and fabric-filled phenolic molding materials. The standard blocks required a special curing cycle of 2 1/2 hr., which necessitated charging the mold cold, curing at 320° F. and cooling to 140° F. before discharging in order to produce blister-free pieces. The heatronic-molded blocks were cured 5 min. and were discharged hot. The results showed no

particular variation in property as a function of location in either standard or heatronic blocks, except in density. Heatronic-molded blocks were 0.5 to 1.0 percent lower in density in the center of the block, due to the swelling effect resulting from the combination of short cure and hot discharge. However, average tensile strengths (see Table II) of heatronic-molded blocks were 20 percent higher than standard-molded blocks; average elongation was 40 percent greater; and impact strength 7 percent higher, with generally lower average deviations. This greater uniformity obtained on such heavy sections should be especially valuable as the size of commercial moldings increases.

Equivalent advantages have been found for small pieces and thin sections. Closures have been heatronic-molded with a cure time as low as 7 sec. with 25 percent greater torque strength than standard-molded closures cured 45 seconds.

A detailed discussion of industrial parts now being heatronic-molded is not possible since many of the parts and installations are of a confidential nature. However, mention of a few, besides those previously described<sup>2-6</sup>, will illustrate some other practical advantages not previously mentioned.

**Propeller block**—Made of fabric-filled phenolic by transfer molding. Closing time of mold was reduced from 1 min. to 12 sec. and curing time from 12 min. to 2 minutes. Less deforming of inserts was experienced and fewer rejections were obtained because all pieces were filled completely.

**Lamp housing**—Transfer molded of fabric-filled phenolic using 1 1/2-lb. charge. Closing time was reduced from over one minute to 3 seconds. Normally, the mold could not be filled, but the heatronic process made the job practical. Cure time was 7 min., but mold construction prevented optimum use of process.

**Transmitter cup**—Molded in a 4-cavity compression die from diced phenolic material. Cure time, 2 minutes. Considerable reduction was found in pin breakage and tremendous advantage was obtained in appearance and freedom from blistering and precuring. The process is still not being used to full advantage because of the long bench assembly time required.

**Fire extinguisher horn**—Molded in 2-cavity compression die from improved impact-resistant phenolic. Previously, difficulty was experienced in filling the piece. Cure of 2 min. was found to be ample, but it was not reduced because of assembly time required at the bench.

**Ignition equipment**—Molding pressure reduced from 4200 to 1600 p.s.i., the reduced pressure and increased plasticity eliminating the hazard of shearing inserts. Curing cycle was reduced from 6 min. to 1 minute.

**Electronic housing**—There was serious pin breakage and variation in dimensions when oven-preheated material was used. With heatronic molding, dimensional variations and pin breakage were practically eliminated, with a simultaneous reduction in cure from 3 min. to 1 1/2 minutes.

**Junction box**—Required 1-lb. charge of fabric-filled phenolic. Heaviest section is 5/8 in. thick. Cure time was reduced from 5 min. to 1 1/2 minutes.

**Telephone handset**—Compression molded in 2-cavity die from fabric-filled phenolic. The over-all cycle was reduced from 8 min. to 3 minutes.

**Airplane control pulley**—Transfer molded from phenolic

<sup>2</sup> Molding with Radio Frequency," by W. M. Witty, *MODERN PLASTICS* 20, 83-85, 132-133 (May 1943).

<sup>3</sup> "New Applications of Heatronic Molding," *MODERN PLASTICS* 21, 106-107 (Nov. 1943).

<sup>4</sup> "Fire-Fighting Horn," *MODERN PLASTICS* 21, 116-18, 170-2 (Jan. 1944).

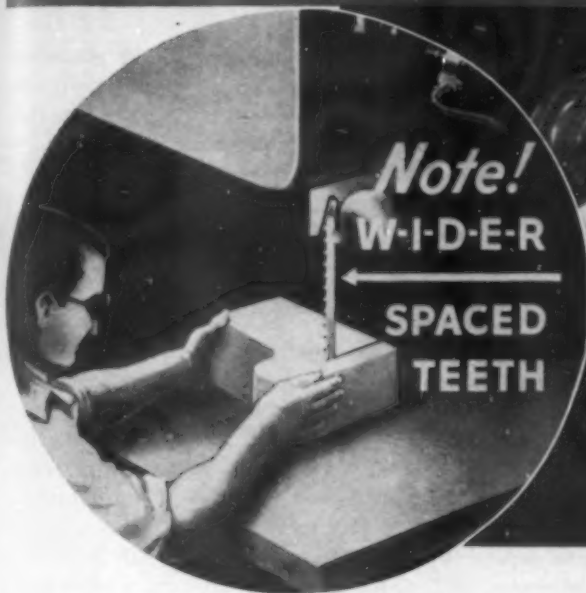
<sup>5</sup> "High Density through High Frequency," by V. W. Sherman, *MODERN PLASTICS* 21, 108-109, 172 (Mar. 1944).

<sup>6</sup> "Molding with High-Frequency Power," 1944 *Plastics Catalog*, 455-456, 458, 462, 464, 466.

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**Insurok**—16 square inches per minute

**Fabric Base Phenolic**  $1\frac{1}{2}$ " thick—60 to 90 square inches per minute

**Cemesto**  $1\frac{1}{2}$ " thick—180 square inches per minute

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impact-resistant molding material. Heatronic molding produced sounder pulleys having improved flange strength. It also enabled the use of a stiffer material at reduced pressure. Cure was reduced from 5 min. to 1 minute.

**Terminal strip**—Molded from woodflour-filled phenolic in 3½ minutes. Heatronic process eliminated after-warpage.

These are just a few of the many installations which are helping in the production of more and better parts for the war effort. As electronic equipment becomes more readily available, other manifold uses will be found which will contribute to the over-all reduction in cost of molding and thus help expand the whole industry.

#### Acknowledgments

The authors wish to acknowledge gratefully the assistance of R. E. Nicolson, of the Research and Development Laboratories, who collaborated in this work, and of Thomas Hazen, of the Manufacturing Division, Bakelite Corp., who made many of the electrical tests.

## New name in resins

(Continued from page 86) jacketing for protection against oil, chemicals, ozone, water and abrasion. Storage battery separator sheets, battery, fuze and switch boxes, flexible conduit and sleeving.

**Extruded products**—Tubing of all kinds—especially tubes for the conveying of acids, alkalis, air, oil, grease and beverages; for electrochemical and photographic uses; and for garden hose. Monofilaments for use in screens and fabrics.

**Gaskets and packing**—Gaskets and packing for pipe, and equipment couplings for chemicals, oils and greases and for vacuum service.

**Molded products**—An almost unlimited range of applications in both injection and compression molding. Piston cups and seals for grease guns, buckets and ladles for chemical service, storage battery jars and cases, grommets for aircraft and motor vehicles, valve disks and bellows.

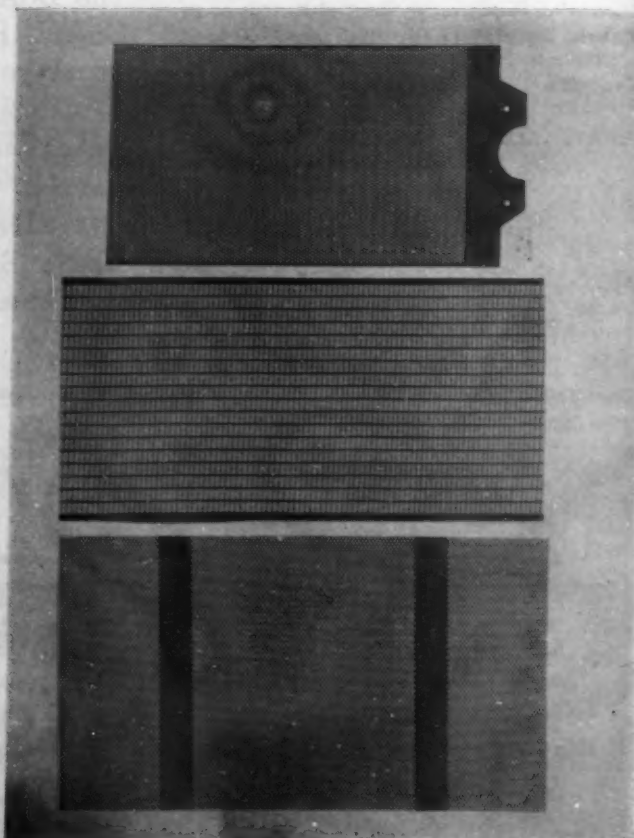
**Protective coatings**—For covering plating racks, tanks, cables, wire, conduits, bus bars, fume ducts, superstructures, anode forms and pipe lines.

**Coated fabrics**—Industrial aprons, gloves and protective equipment; Army and Navy raincoats, ground sheets, ski tents, photographic tents, foul-weather clothing, parkas and trousers; aircraft wing tarpaulins; aircraft and motor vehicle upholstery and artificial leather; aircraft hangar door and trench door covers; flotation bags, jungle bags and jungle hammocks; hospital sheeting and oxygen tents; shower curtains, umbrellas, baby pants, awnings, window shades and curtains, floor coverings; luggage, garment bags, bowl covers and table cloths.

**Calendered and cast sheets and films**—A great variety of uses from containers and packages for military machinery and ordnance material to bags, protective covers and packages for foodstuffs and pharmaceutical products—applications where heat-sealability, toughness, stretchability, resistance to moisture, chemicals and aging are of importance—clothing, shoe soles and electrical tapes.

**Coated papers**—For a multitude of uses especially in packaging and closure field and for wall paper. (Please turn to next page)

8—All of these extruded channels and tubing, including one piece that is fabric coated, are made from polyvinyl resin. The 2 electrical connectors are compression molded of the same type of material. 9—The good corrosion resistance of the vinyl resins make them well suited for use in battery separator sheets. After the sheets are calendered with this resin and die cut, the "holes" are fed back through the calender thereby effecting a saving



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TABLE II.—PROPERTIES OF GEON PLASTICS

*Processing properties*

Milling temp., ° F.	240-290
Banbury temp., ° F.	240-260
Calendering temp., ° F.	285-300
Injection molding temp., ° F.	310-375
Injection molding pressure, p.s.i.	15,000-25,000
Compression molding temp., ° F.	330-340
Compression molding pressure, p.s.i.	100
Mold shrinkage, in. per in.	.015
Extrusion temp., ° F.	Feed 280, head and die 350

*General physical and chemical properties*

	Non-rigid	Rigid
Tensile strength, p.s.i.	1500-3200	9000
Elongation, percent	200-400	2
Modulus of elasticity in tension, p.s.i.	1100-1400	
Hardness—Brinell (A.S.T.M. D 314-39)	28-41	
Coefficient of friction		
Dry	1.20-1.80	.13-.16
Lubricated	.05-.10	.13-.16
Specific gravity	1.20-1.40	
Specific volume, cu. in. per lb.	23.0-19.8	
Specific heat, gr. cal.	.32-.51	
Specific heat conductivity, 10 <sup>-4</sup> , cal./sec./sq. cm./° C./cm.	3.3 to 3.9	

Flammability,<sup>a</sup> A.S.T.M. D 635-41T Non-flammable

Physiological properties<sup>a</sup>—The resins are odorless, tasteless and non-toxic.

Gas diffusion resistance—Exceptionally good.

Corrosion resistance<sup>a</sup>—Withstands 45 percent caustic, pickling acid, plating baths, hydrofluoric acid, chromic acid and acids and bases in general, except sulfuric acid of 93 percent or higher concentration and glacial acetic acid.

Solvent resistance<sup>a</sup>—Generally unaffected except by the following solvents or swelling agents: 1) Organic compounds containing nitro or chlorine groups, 2) aliphatic or aromatic ketones, 3) aromatic amino compounds, 4) lacquer solvents and 5) acetic anhydride.

Aging<sup>a</sup>—Under normal conditions there is almost complete resistance to aging except for the possible loss of certain volatile plasticizers. These resins are notable in the field of vinyls for their unusual stability; however, exposure to temperatures of 375° F. for extended periods will lead to decomposition.

Resistance to abrasion, flexing and tearing—The plastics are outstanding in these characteristics. Compared with natural rubber compounds, which have excellent resistance and have hitherto been considered as models, Geon plastics are five to ten times better.

<sup>a</sup> Satisfactory resistance depends only upon proper compounding.

## Injection mold design

(Continued from page 105)

### Types of runners

Runners are channels that lead from the sprue to the individual cavities, and they can be machined on either half of mold. However, in most cases, they should be on the ejection or moving half of the mold in order to increase the tendency of the molded articles to remain in that particular half when the mold is opened. The runners should be short and as direct as possible so as to reduce the amount of sprue scrap. This is true even though the scrap can be remolded.

Sharp turns should be avoided since they increase the re-

sistance of the material to flow. Friction between the metal and material in its plastic state is very high. Consequently, channels should be highly polished to keep this friction to a minimum and to help reduce the molding pressure that is required to fill out the cavities.

Three general types of runners (Fig. 11) are in use—round, half round and trapezoidal. Preference is given the round runner since it has the least amount of friction surface. This type allows the mass in the center to move more rapidly, thereby allowing greater molding efficiency at reduced costs.

This review of some of the fundamental rules and principles necessary for the successful operation of an injection mold will be continued in the July issue of MODERN PLASTICS. Part II of this article will present in detail the advantages and disadvantages of various types of gates and treat of other design details.

## On the mark

(Continued from page 95) indicator called for two pointers—one approximately  $\frac{1}{2}$  in. above the other—to be set close to the dial face, it was necessary to make the dial in two parts. This arrangement raised two new problems. A support plate was needed to hold the outer ring approximately  $\frac{1}{2}$  in. higher than the inner disk. In addition, it was essential that a method of illumination be devised in which the light source was behind the dial face yet in a position available for quick and easy bulb replacement in the event of damage.

The solution to both these problems was a diffuser-support plate (Fig. 2) which is molded of polystyrene in a single-cavity die with all the small holes molded in as an integral part of the initial operation. The gate which is in the center, is bored out and then reamed to obtain the larger center opening. In the early design a block of methyl methacrylate was machined to the shape needed for this part. However, polystyrene was adopted when the supply of methyl methacrylate became short. By attaching the inner polyvinyl chloride-acetate disk to the bottom of the polystyrene support plate and the outer disk to the rim of the plate, the  $\frac{1}{2}$ -in. differential between the dial faces is achieved.

In the assembly operation the inner disk is riveted to the diffuser-support plate while the outer disk is fastened to the plate in the same operation that fastens the diffuser-support plate to the metal housing which holds the entire azimuth indicator unit. The holes through the feed were first made to accept a machine screw with a very small tolerance. Assembly experience indicated that counter-boring the holes in the feet from the bottom to about two-thirds of their length permitted easier assembly because this method gave the machine screws more play with which to "find" the corresponding holes in the casting.

Illumination of the dials is obtained from two small bulbs set diametrically opposite each other in the outer metal housing. To avoid a spotlighting effect where the lamps are directly adjacent to the polystyrene diffuser-support plate, the outer rim of this plastic part is made opaque for a distance of approximately 1 in. on either side of the light source. In addition to assuring a more equal distribution of the light throughout the diffuser plate, this opaquing serves to diffuse the light upward so that the numerals and calibrations appear clearly in red when the instrument is used after dark. Since the dial faces are on two levels, a gap exists between the plastic disks. To prevent light from coming through this open section, it was necessary to opaque the outer surface of the riser wall of the diffuser-support plate—the part of the

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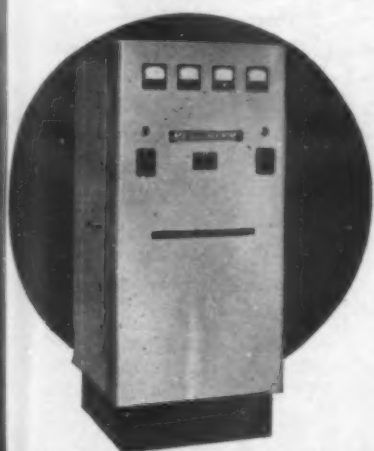
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The 4" diameter preform shown was made in a 75 ton press and heated to full molding temperature in 30 seconds with the popular 3 KW Megatherm.

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Megatherm's High Frequency Heat achieves this homogeneous plastic state in seconds! And that's not all . . .

As a result mold pressures are drastically reduced—since the uniformly heated material flows more easily. This means less stress on die inserts and no internal stress in the form when curing cycle is completed. Thus you can do precision molding, free of porosity, with lighter equipment. And you can reduce curing time from minutes to seconds, double or triple production, and eliminate warping and cracking—even on compression molding of thick sections!

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polystyrene plate which showed between the two dial faces. As a result, the only light visible from the top is the red glow shining through the numerals and calibrations.

The use of plastics for the dial face and diffuser-support plate of the azimuth indicator can be said to have four outstanding advantages over the proposed cast-metal unit. Not only is the production rate high, but the plastic unit is light and adds very little to the over-all weight of the instrument. Of even greater importance is the fact that the plastic parts are readily interchangeable. It has been estimated that the cost of the entire plastic unit is less than half the estimated cost of the metal parts which were originally proposed. On all counts plastics may be said to have scored another triumph in a long list of problems that have been met and solved.

*Credits—Material: Vinylite and Styron. Designed by Hope Equipment Co. Molded by G. Felsenthal & Sons. Azimuth indicator manufactured by Beam Manufacturing Co. and May Oil Burner Co. for U. S. Army*

## Transfer molding

(Continued from page 118) preform immediately flows under pressure and the mold cavity is filled in a matter of seconds with a completely homogeneous mass. This flow characteristic explains the ability of high-frequency heated plastic products to withstand more successfully the tests for flexural and impact strength.

**Shorter curing time**—There is a tendency on the part of the molder to fail to take full advantage of the high-frequency process. Some of this reluctance may be broken down when it is realized that the curing time allowed for a given piece when conventional preheating methods are employed includes a factor to take care of the under-heating of the material before it enters the press. How much the curing time of a given piece may be shortened when high-frequency heating is used will be a matter of test. In the case of the pulleys (Fig. 2), this interval was shortened 50 percent with the probability that it can be reduced still further. On another piece, a complicated gun turret control grip which is transfer molded in a 4-cavity die, the curing time was reduced by 60 percent. Table I gives some comparative values for oven heating and high-frequency heating which can be obtained with this installation.

**Lower ram pressure**—The ability to mold with lower ram pressure is immediately evident upon examination of the dies after a high-frequency heated preform has been molded using the same ram pressure as that employed with conventional heating. In the case of the control the press was operated at 100 tons when conventional heating was used and, when the mold was opened, the flash extended well over the face area of the die. This same molding operation was accomplished by

high-frequency preheating with 65 tons on the ram. On the pulleys the ram pressure was successfully dropped from 75 to 55 tons.

**Less tool maintenance**—This reduction is brought about by the increased plasticity of the material during flow with a resultant decrease in abrasion on the surfaces of the dies. Inserts and pins are less likely to be damaged when high-frequency heating is employed.

**Improved product**—This result is best demonstrated by an analysis of the production figures for the period during which the high-frequency equipment has been in operation. These figures show that there is both a definite improvement in the quality of the product and a substantial increase in production. In a test period of 585 hr. during which high frequency was used for preheating, an increase of 24.2 percent was obtained in press production as compared with the results obtained from conventional heating methods. Production of finished pieces after all finishing and inspection operations have been performed was increased approximately 20 percent.

Experience gained with this high-frequency installation indicated that in order to obtain full advantage of this type of heating, several precautions must be taken in the preforming operation. If a preform varies appreciably in thickness from one end to the other, the resultant temperature will vary accordingly. The reason for this is that all portions of the faces of the preform are not equidistant from the electrodes. Whenever a solid material is placed between 2 electrodes, one of which is separated from the material by an air space, the total voltage across the 2 plates will divide inversely as the capacitance of the 2 electrical condensers which are formed.

For a given area and given spacing, a condenser in which the dielectric is air will have a lower capacitance than a condenser of the same area and spacing which uses other than air as a dielectric. Thus, in the 2 condensers formed above, the air space will have the lower capacitance. Therefore, a greater proportion of the voltage will appear across the air space and a lesser proportion across the plastic preform. Since the thickness of the preform is not uniform, the voltage applied to it will also be non-uniform. If the upper electrode was positioned so that the air space was uniform from one end to the other, the voltage would also be uniform and overheating would occur at the thin section. Fortunately this condition is not critical, and wide tolerances in thickness are permissible. However, preforming should be controlled to insure that this condition does not become aggravated.

Variation in density of the material is another factor which affects the uniform heating of preforms by high frequency. A tightly packed preform will heat more readily than one in which the material is loosely pressed. Unless some effort is made during preforming to effect a fair distribution of the bulky material over the area that is involved, the resultant product will have hard and soft spots and non-uniform heating will result.

(Please turn to next page)

TABLE I—COMPARATIVE VALUES FOR OVEN AND HIGH-FREQUENCY HEATING

Material	No. of preforms	Size of preform in.	Total weight of preforms oz.	Preheat time		Mold closing		Curing	
				Oven	H.f.	Oven	H.f.	Oven	H.f.
					sec.		sec.		sec.
(1) Bakelite 16089	1	$\frac{3}{4} \times 1\frac{1}{4} \times 12$	7	600	45	25	3	180	90
(2) Bakelite 10136	6	$\frac{3}{4} \times 3 \times 4$	24	900	55	40	10	300	120
(3) Bakelite 10136	2	$1 \times 1\frac{1}{4} \times 12$	20	900	70	40	12	900	480
(3) Bakelite 3510	2	$1 \times 1\frac{1}{4} \times 12$	20	900	75	"	23	900	480

" Did not fill out.

(1) This is for the pulley shown in Fig. 1.

(2) This is for the gun-grip mentioned in the text.

(3) These are for a complicated electrical part with 6 rings and 9 inserts which was molded using 2 different materials.



## *Maybe the answer is* **MOLDED PLASTICS**

Doing the unusual job . . . and doing it better . . . is the usual thing for plastics these days. For instance, airplane radio masts . . . valve parts for plumbing fixtures . . . portable tool housings . . . even the familiar radio cabinet . . . were jobs where the use of plastics was not, perhaps, so obvious at first. But results have shown it to be the *right* answer.

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Extra-strength plastics are proving ideal materials for portable electric tool housings. Their insulating qualities protect the operator; they are light in weight and always comfortable to handle. The Precise 35 Grinder is an excellent illustration.

It is only a few years since plastic radio cabinets were a novelty, but they quickly demonstrated that their rich color and permanent finish carry a powerful sales appeal. In the Detrola cabinet here shown, two contrasting materials are effectively combined.

The plastic molded piston of the famous Sloan Victory Flush Valve has less than half as many parts as its predecessor of brass. Thus, it saves not only scarce metal, but even more vital man and machine hours.

MOLDED BY



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A third factor involved in the uniform heating of preforms is variation in the moisture content of the material. To explain this condition, a discussion of the electric circuit of which the electrodes are a part is necessary. In a resonant circuit such as the one employed in this work, the flow of current is only limited by the voltage available and the impedance of the material. The presence of moisture in the plastic increases its power factor and, therefore, the loss factor. This increase has two effects: it causes the material to heat faster and it decreases the voltage gradient across the material.

If without changing the adjustment a preform containing no moisture is placed between electrodes which are set for the heating of material having a given moisture content, the increased voltage due to the dry material might cause flash-over to occur between the electrodes and would probably puncture the preform. If the preforms are consistent in respect to moisture content, no trouble will be experienced. However dry preforms heat at a much slower rate. While the amount of moisture is not critical it should not be allowed to vary over a wide range. Both from the standpoint of good molding practice and high-frequency heating, the amount of moisture should never be permitted to approach zero.

In conclusion it should be pointed out that the foregoing statements do not mean that if the factors under discussion are neglected, a good job of preheating by high frequency cannot be done. Rather they indicate that attention paid to these various details will pay dividends in a speedier, more thorough and more efficient use of the equipment.

*Credits—Material: Bakelite. Molded by Plastic Manufacturers, Inc. High-frequency equipment manufactured by Induction Heating Corp.*

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## "Information, Please"

(Continued from page 82) the club yokelry. Manufacturers who think that the housewife is not interested in science, popularly explained, should reflect that the food and dairy companies' advertising of vitamins, hemoglobin and calories established a whole new technology of nutrition.

Luxury goods, therefore, and larger items of household equipment might to advantage carry a more elaborate technical label. Keeping in mind that the skeleton of an informative label is a statement of what the material is and its properties, the manufacturer may adorn the skeleton as he wishes. As to the form, size, shape and appearance of the label, they are limited only by good taste and the demands of the article. Although the current trend is toward undecorated labels printed like an auditor's statement with the specifications in columns, an informative label is just as informative when printed with suggestive decorations or illustrations. Enormously popular a few years ago were small tags of transparent acetate with a gold crown at the top. They succeeded in giving a faint suggestion of royalty and the Romanoffs along with quite definite information that the material met standard tests.

In plastic manufactures, the writing of an elaborate technical label is complicated by the fact that their basic chemistry is so little understood by the public that any elaborate informative labeling program should be accompanied by an educational campaign or a concerted advertising campaign to explain the terms. It is further complicated by the fact that properties vary in formulas of any given material. For most of the inexpensive consumer products it is sufficient 1) to identify the material, 2) to classify it

either as to its chemical origins or as one of a group of thermosetting or thermoplastic materials and 3) to state its advantages and limitations. One molder suggests that the ideal classification is: 1) its identity as one of a group of thermosetting or thermoplastic materials, 2) its classification as to chemical origin, stating, for instance, that cellulose acetate is derived from cotton linters and acetic acid and 3) its classification by trade name. He believes these subdivisions should be followed in the order listed. An objection to this is that it would be extremely difficult to explain to the public the words "thermoplastic" and "thermosetting" on a label without an accompanying educational advertising campaign, since if they are insufficiently explained, these words will fall on unresponsive ears.

The most crying need for informative labels in plastics is in the field of kitchen manufactures, where the exigencies of war produced many experiments in small utensils for chain-store consumption. Some were definitely misapplications, while others which would have been serviceable with proper care brought complaints and prejudiced many customers against "plastics." For instance, the cellulose acetate measuring spoons on the counters of the dime stores were said by most managers to sell well because of their bright colors, but customers afterward complained of warping. A small tag like that shown in Fig. 12 would remove such causes of complaint.

If it is objected, as it undoubtedly will be, that the expense of printing such a label on a dime-store article is too great, we must reiterate that one of the most successful chain-store plastic utensils is attached to a card which carries careful washing instructions and is a rudimentary informative label. In size it is larger and more expensive than the one above, and it carries some advertising. It identifies the material only as "plastic."

Other cellulose acetate labels might conceivably warn about other limitations—high water absorption, scratching, burning, brittleness at low temperatures—if these limitations are important in the use of the article. Acetate trim on the dashboard of an automobile might conceivably mention scratching, but the question of sterilization by hot water or alcohol does not enter into this application, of course. Use of any kitchen utensil frequently involves immersing it in boiling water or placing it on a hot stove, and all plastic labels for kitchenware should state the susceptibility of the article in these two respects. The fact that plastic kitchenware has gone out unlabeled in these two respects has created unwarranted prejudice against certain applications, which is particularly unfortunate in view of the excellent labeling of metal and glass kitchenware, said by one retail authority to be the best in the field. Like that photographed in Fig. 6, most of the glass labels give pertinent and interesting information about the material. The public has, as a result, conceived an impression that plastics are less serviceable than glass for kitchen use. Other kitchen factors which are important in labeling are susceptibility to fruit juices, oil, alcohol, water absorption and breakage. Figures 7 and 8 show suggested labels for sets of measuring cups, one made of styrene and one of cellulose acetate.

Among the most beautiful of all the prewar plastic manufactures were the cast phenolic hand mirrors and hair brushes, unsurpassed for their jewel colors and surface sheen. In style and design, the best brushes and mirrors competed well with those of any age. They were enormously popular, too, selling in the drug stores and department stores at prices ranging from \$3 to \$10. Figure 10 shows a suggested



## WHAT IS MOSINEE *Paperology?*

Just as metallurgy scientifically controls alloys to meet requirements of strength, toughness, hardness, corrosive action, etc., in *metals*, Mosinee Paperology now offers scientific control of paper characteristics.

Thus, important advances in product engineering and in mass production are now possible with paper "alloys". Through Mosinee Paperology, paper can be engineered to obtain the combination of properties required for product parts which formerly used more critical and costly materials. Strength, density for laminating, controlled absorbency and acidity, softness, pliability, uniform formation . . . and many other essential qualities . . . can be provided through Mosinee Paperology . . . as well as characteristics for speeding output, reducing work stoppage and loss.

Mosinee Paperology creates many opportunities for manufacturers to improve products, reduce costs, expand markets. Mosinee is ready to help you "make the most of paper."



**MOSINEE** PAPER MILLS COMPANY  
MOSINEE WISCONSIN  
*Essential Paper Makers*

Please address  
your letter  
"Attention Dept. A"

label for a honey-colored cast phenolic hairbrush. This label contains considerable advertising copy at the top, followed by factual information. Where advertising is to be included in an informative label it should be isolated, either at the top or at the bottom of the label. This label gives, after the advertising copy, the identity of the material, its classification as to origin, class (thermoplastic or thermosetting), and its trade name.

One of the big, square, handsome simulated tortoise shell compacts framed in silver might carry a label like that shown in Fig. 9. For a compact, sterilizing and color fastness are not pertinent limitations, but scratching is. On the other hand, babies' plastic toys might mention on their labels that they are tasteless, odorless, non-flammable, non-toxic, can be easily kept clean and have fast color.

In each new field of plastic manufactures the manufacturer or molder should consider wherein the plastic article differs from its predecessor, and write his label accordingly. What are the ways in which the plastic article is different from the traditional one? What different care does it require, and what new properties has it? Many new war applications will be continued in civilian use and find their way to retail counters. For example, an Army mess tray molded of melamine could be used for hors d'oeuvres or for a nursery tray. It has six angular depressed compartments so curiously designed that hors d'oeuvres inevitably spring to mind. The large center compartment appears to be especially designed for celery, and the smaller angular compartments lead one on to radishes, stuffed olives, pate fois, and caviar (or, anyway, anchovies). This tray might carry a label (Fig. 11) sentimentalizing somewhat on its Army service.

---

#### MASTER LABEL OUTLINE

*(It is understood, of course, that labels should conform to local, State or Federal regulations where such exist.)*

##### WHAT IT WILL DO (Performance)

Degree of color permanence; shrinkage or stretchage; breaking strength; seam slippage; resistance to water, perspiration, wind, wear; light, heat and power tests; power consumption; cost of upkeep; etc.

##### WHAT IT IS MADE OF (Composition)

Kind and quality of fiber, metal, wood, leather, ceramics, cement, rock, fur, plastics, petroleum products, rubber, paper, bone, chemicals, drugs; ingredients of food products; etc.

##### HOW IT IS MADE (Construction)

Size, weight, number of yarns per inch, weave, number of stitches per inch, finish, ply, cut, hand or machine made, pressed, molded, stamped, inlaid, etc.

##### HOW TO CARE FOR IT

Detailed instructions for washing and/or cleaning; precautions to be observed in cleaning or in storage; refrigeration; oiling and greasing; polishing, etc.

##### RECOMMENDED USES

Purposes for which it is most suitable; recipes, etc.

##### NAME OF MANUFACTURER OR DISTRIBUTOR

Name and address of the manufacturer or distributor.

*This outline, which first appeared in the Council's preliminary manual, Informative Labeling, has proved helpful in organizing the copy to be included in informative labels.*

A natural trend of thought leads from the hors d'oeuvres tray to the bar. After the war, many bars, tables, cocktail trays and bar accessories will undoubtedly be made of laminated phenolic material, which is stronger than wood but may look like a piece of well-varnished wood with a grain of crotch mahogany. Or it may have painted designs or metal stencils which seem to be just below the varnish, but are actually set into the material before it goes into the presses. We offer the following label shown in Fig. 13 for a phenolic laminated portable bar.

Many an advertising man will take issue with the labels presented on these pages, not on the ground of their content, but on the ground of their negative phraseology and the injunction "Do not" in place of "Never." There is a theory current among advertising writers that the public is allergic to negatives and that "not" is a negative while "never" is not a negative. In the labeling of rayon they believe that the injunction "Always use a warm, never a hot, iron" was very much more positive and pleasing to the public than if they had said, "Do not use a hot iron." This hairsplitting among negatives seems to suggest that they have never read that most negative of all poems in the language, *The Raven*, in which the word "not" is not once used. In writing labels, as in writing anything else, clarity is the first essential. The clearest and most forceful statement is the one to use regardless of whether it involves "never" or "not" or both of them. Use of the negative, in fact, is in line with the informative labeling program, and the down-to-earth debunking trends of consumer education.

The suggested labels shown here are very rudimentary informative labels for the reason that the consumer at large is in complete ignorance of even the names of the various plastic materials, and that, in plastic consumer goods (with the exception of synthetic textiles), no general program of standards intelligible to the consumer has yet been adopted. As the public is gradually educated to the realization that there are many different plastics within the classifications "thermosetting" and "thermoplastic," the specific information on the labels should be increased. But the technical information, as it is supplied bit by bit on each label, should be explained in very simple terms until it is assimilated by the buyer.

Assembly goods, on the other hand, might to advantage carry a more elaborate and more technical label. When molded plastic parts are used in combination with parts made of other materials, the manufacturer should consult with the molder before he writes the label or book of instructions which accompanies his product. For example, with such items of household equipment as vacuum cleaners, mechanical refrigerators and washing machines there customarily goes a booklet which tells the purchaser something of the nature and quality of the materials used in their manufacture and gives instructions on how to operate and how to take care of them. If specific technical information is supplied by the molder, the manufacturer can in his booklet specify which parts of these appliances are plastic, list such properties of the material as are pertinent to the application, and tell the user how to treat the plastic units of the assemblage in order to prolong their life and ensure good service. As much technical data should be included on the plastic parts as is given for the metal parts, so that the consumer will have on hand complete factual information to guide future buying.

A technical label is still more necessary for industrial goods, most of whose users are better equipped to understand the terms involved. Since precision and accuracy of operation

LET THIS BULLETIN TELL YOU ABOUT 24-HOUR-A-DAY OPERATION OF

# AIRTRONICS Preheaters

Speed molding cycles with  
AIRTRONICS' preheaters



**Model CB**  
3500 BTU per hour output  
35 sq. in. electrode area

Many new design and construction features are the basis for AIRTRONICS' record for efficiency and dependability. Built expressly to meet the requirements of compression molders, they increase output and reduce costs. Get complete information on the Model CB AIRTRONICS preheaters. Send for your copy of this new bulletin today.

**AIR**  
**MANUFACTURING CO.**  
Division of Aerovox Corporation  
NEW YORK CHICAGO LOS ANGELES

## AIRTRONICS MANUFACTURING CO.

NEW YORK: 31-28 Queens Blvd., Long Island City, 1  
CHICAGO: 121 West Wacker Drive, Zone 1  
LOS ANGELES: 5245 W. San Fernando Road, Zone 26

AIRTRONICS MANUFACTURING COMPANY  
(use address nearest you)

Please send information on Airtronics preheaters as offered in  
Modern Plastics magazine.

Name \_\_\_\_\_ Title \_\_\_\_\_

Firm \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

are of the utmost importance in the industrial field, labels or booklets should be worked out by the material supplier, the molder and the manufacturer. The amount and nature of the information given will, of course, depend on the intricacy of the plastic product itself and the exactitude of the work it is to perform.

The manufacturer of plastic articles who remains skeptical of the value, or rather the necessity, for informative labeling should telephone at random to a few of the largest textile companies. He will find that most of them not only have informative labeling but also educational departments from which they send out research information to schools, consumer organizations and stores. He will probably not be able to talk to the head of the educational department who is just starting on a lecture and film tour, but her secretary will be glad to tell him about the lectures and films they arrange for schools and women's clubs and the research bulletins they issue on textiles for use in colleges. If he calls his State University, he will find that informative labeling enters into a dazzling array of courses in departments he didn't know existed, with names like Marketing, Retailing, Economics of the Household, etc. The hardy telephoner can pursue his way right into the bastions of the women's clubs and consumer committees, or some of the societies that work on standards and testing and the testing laboratories of the chain and department stores.

These researches will lead him to consider the Government regulations on labeling in fields other than plastics. He will certainly want to reach (but perhaps not by long distance) the heads of the school boards in the South and Middle West to ask them about their distributive programs for educating salespeople and consumers about merchandise. After that he may want to relax, but he will not doubt that informative labeling is a high point in the tidal wave of consumer education which is sweeping the country. He will probably be heard muttering to himself in double negatives that "Information, please" is the trend of the times.

### Acknowledgements

For assistance in the preparation of this article, we are indebted to the National Consumer-Retailer Council, Inc.; to the Home Economics Departments of Teachers College of Columbia University, Cornell University and New York University; to managers of a number of retail and chain stores; and to the plastics materials manufacturers, all of whom generously supplied us with material, made suggestions or gave advice.

## Up to the minute

(Continued from page 102) with two rams, one vertical and the other horizontal. Figure 2 shows the split cavity and bottom plug with the splits in the open position. This mold design eliminated to a great extent the difficulties previously experienced and the finishing operations were thereby greatly reduced.

While the new mold is 20 percent more expensive than the first model, it has increased production 100 percent. The effect has been a reduction in the cost of the individual parts—a factor which augurs well for an eventual over-all saving. This reduction varies from 12 cents in the parts for the 6-in. clock to 32 cents in those for the 8-in. clock.

Because of their high fidelity these clocks might almost be considered as essential equipment aboard ship or in our war production factories. That plastics have enabled this com-

pany to continue production of these clocks is but another instance of the benefits to be derived from the use of this material. By enabling clock manufacturers to maintain their production schedule, plastics have again met the demands of a country at war.

*Credits—Material: Textolite. Molded by General Electric Co., Plastics Divisions, for Seth Thomas Clock Co.*

## One man to a rivet

(Continued from page 92) the rivet is molded in one piece, the wedge-plug forming an integral part of the body. The construction of these rivets is such that the plug of one rivet will fit into the locking end of another. This permits the rivets to be assembled in a long column (Fig. 1) prior to insertion in an automatic applicator. The pieces are so designed that when a rivet is snapped into an assembly hole, an inside wedge action results. This spring action of the rivet holds the two plates being assembled solidly in place pending the riveting operation. A simple rivet gun is then applied to the top edge of the wedge-plug. Through the impact of the gun the plug is driven into the body of the plastic rivet. This action forces apart the four fingers that comprise one end of the rivet so that they take a firm grip on the outside of the plate which is farthest from the operator. The gun is adjusted so that the wedge-plug enters the rivet until the head becomes one solid spherical or flat surface. When the plug has been driven into place the body of the rivet completely fills the assembly hole.

One of the advantages of these newly developed plastic rivets is the method of fracturing away the wedge-plug which actually displaces the man on the "other side"—the man who holds the bucking bar when standard-type rivets are employed. The ease with which these plastic rivets can be applied in any position is emphasized by the possibility of locking together two plates with no supporting background. Tests have indicated that through the lock action of this blind rivet by the wedge principle, uniform pressure is obtained regardless of the operator. Another important advantage of these plastic rivets is that they can be removed without damaging the parts to which they have been fastened. Finally, the method of application is practically soundless.

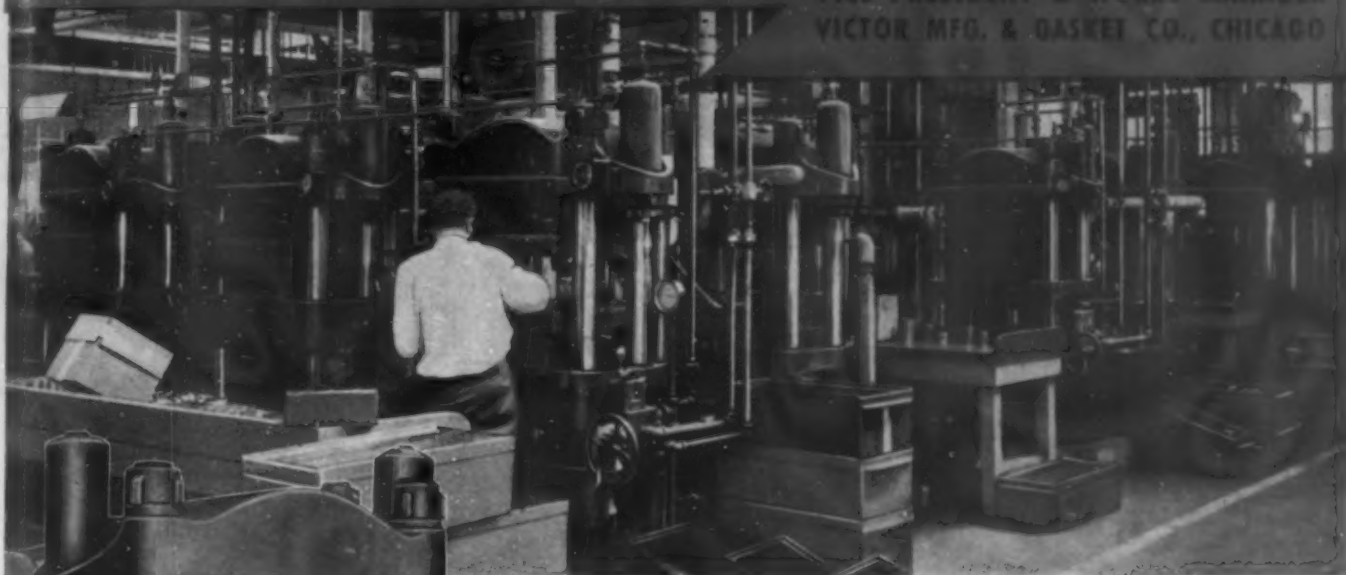
War needs have perfected techniques of laminating a variety of materials such as wood, cardboard and cloth with plastics to form sheets of unusual hardness and strength. The ideal type of locking device for these sheets will naturally be a rivet which can fasten laminated sheets together without cracking or damaging them. The plastic rivet not only meets this requirement but retains the perfection of its own optical surface even after the application of the single blow that is required to lock it in position. In addition, these rivets can be made of the same material as the laminated sheet with which they are employed so that when set in place they become an integral part of the surface.

A further advantage of the blind rivet is its decorative value, a factor which will undoubtedly play an important part in its later applications. A look into the future suggests doors with colored panels of plastic sheeting studded with jewel-like rivets, or glass and plastic laminated window panes held together in their modernistic frames by rivets of crystal clearness. Such possibilities for decorative uses invite the ingenuity of the designer of furniture, frames and containers.

*Credits—Molded by Modglin Co. for the Victory Mfg. Co.*

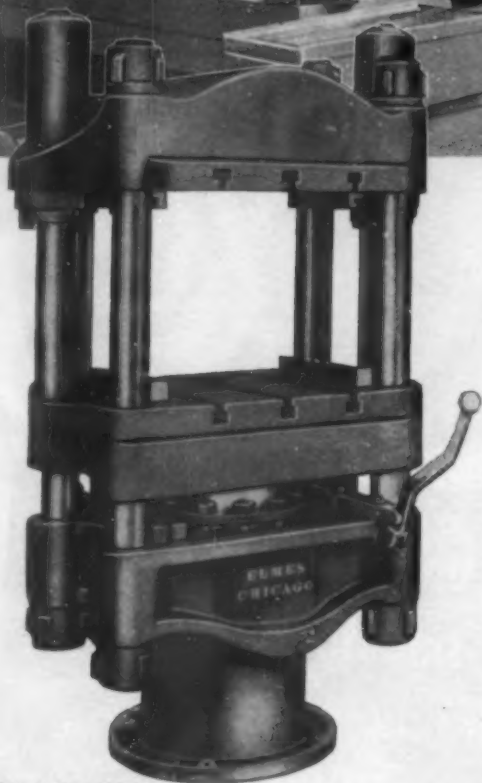
# "These 40 ELMES PRESSES have set a Record!"

REPORTS O. W. CLIFTON,  
VICE PRESIDENT & WORKS MANAGER  
VICTOR MFG. & ASKET CO., CHICAGO



## HERE'S THE COMPLETE STORY IN MR. CLIFTON'S OWN WORDS...

"These forty Elmes presses have set a record in turning out oil seals and other molded products. In the oil seals made by the Victor Company, the synthetic rubber sealing element is molded onto the metal shell or holder. The principal function of an oil seal is to hold lubricant in a bearing. These modern-type seals are widely used both in military equipment of many kinds and in production machinery. That is why we are proud of the performance of this battery of 200-ton presses since they were installed in 1937. They have been operating continuously twenty-four hours a day with no failure. Their simplified system of controls, fast opening and closing speeds, controlled molding speeds, as well as the small amount of attention required by the operators, have made it possible to maintain a high rate of production. A factor in maintaining high production is the accuracy of operation which eliminates loss of press time due to breakage of molds."



MODEL No. 4376

### ELMES 200-TON, HYDRAULIC MOLDING PRESS

Semi-automatic, column-type,  
standard-design molding press



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Recently published, this bulletin describes the presses used for compression and transfer molding. Send for your FREE copy today.

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# ELMES HYDRAULIC EQUIPMENT

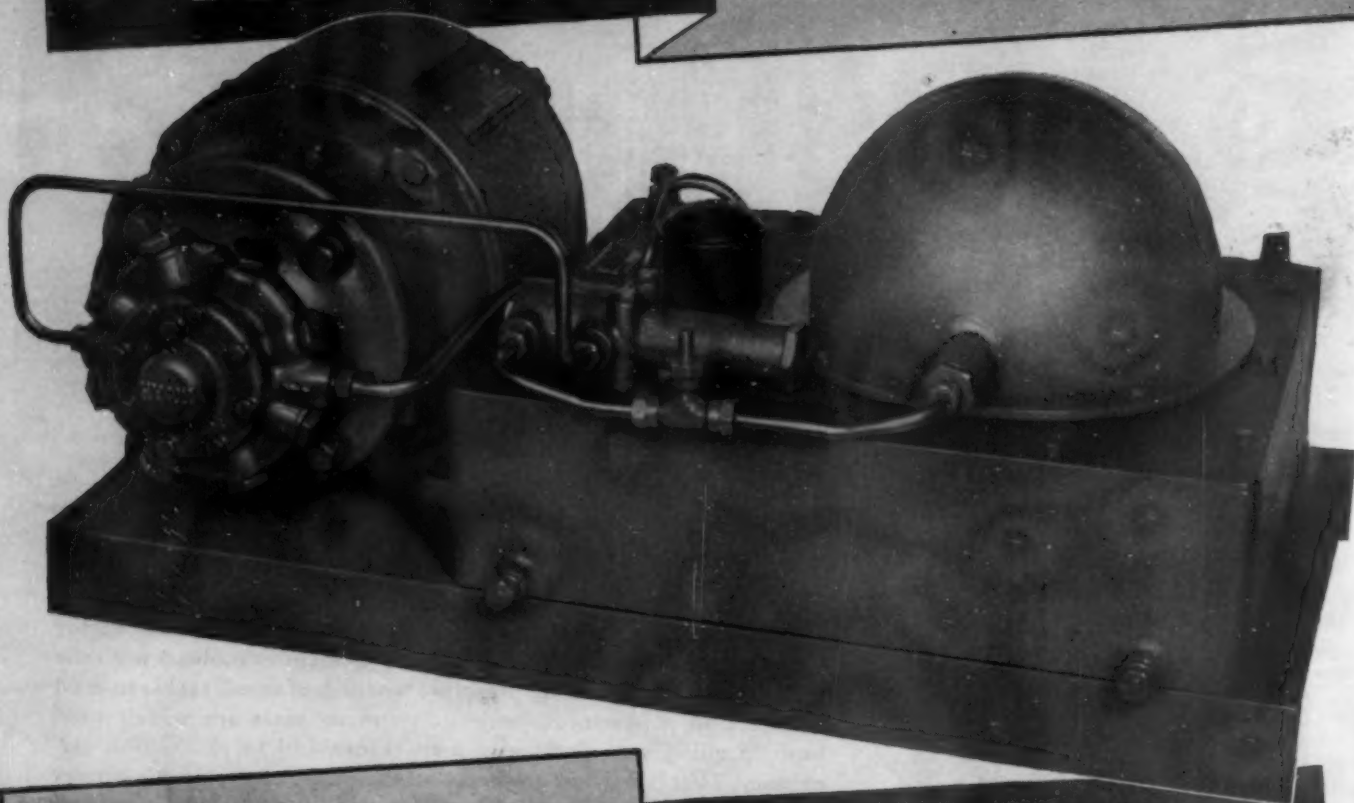
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**3000 p.s.i.  
Hydraulic  
Power Unit**

**3 HP Motor  
8 cylinder Pump  
Unloading Valve  
Accumulator and Reservoir**



**A small compact unit for  
machine tools,  
hydraulic presses  
and test equipment**

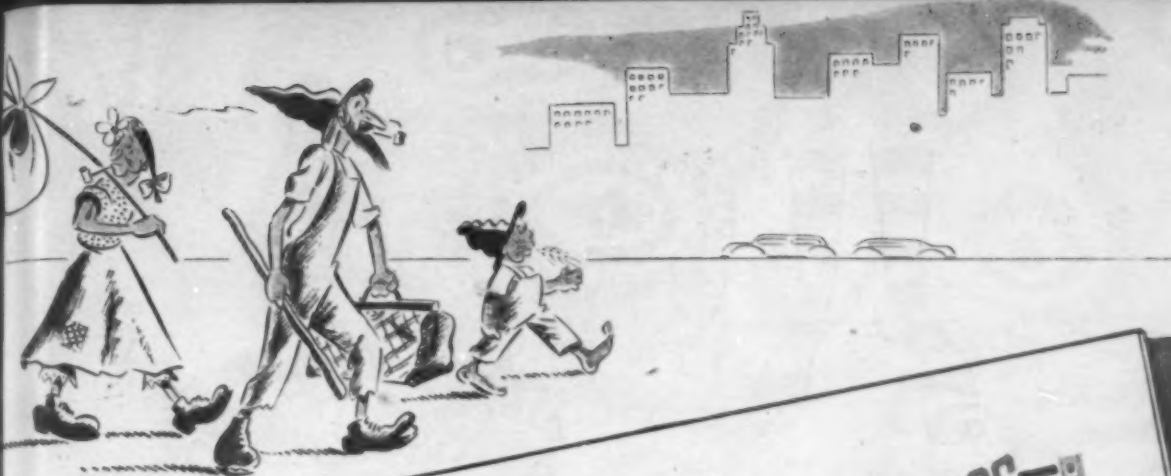
**Quickly and easily installed  
for smooth reliable  
hydraulic operations  
up to 3000 p.s.i.**

*Specifications and Engineering Data  
on Request*

**THE NEW YORK AIR BRAKE COMPANY**

*Hydraulic Division*

420 Lexington Avenue, New York 17, N. Y.



**NORTON LABORATORIES**  
(INCORPORATED)

CUSTOM MOULDERS OF SYNTHETIC PLASTICS  
BAKELITE DUREZ

LOCKPORT, N.Y.

**NORLOC**  
NOVELTIES

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRES, ACCIDENTS OR CAUSES BEYOND OUR CONTROL.  
CONTRACTS WITH AGENTS NOT VALID UNTIL APPROVED BY AN OFFICER

June, 1944

Dear City Slickers:--

Your country cousins are back again. This time, with a message that is, as usual, simple and to the point (we hope).

We are getting into the summer, which used to be a slack one for most industries. But this year it's different. We are busier than ever, like everybody else. That is our little contribution to the general war effort. We mention it just to remind you that although geographically we are not in the very center of things, we are able to contribute some of the toughest molding jobs that the plastics industry has ever been called on to turn out.

It looks peaceful out here with plenty of trees and green grass and flowers and it's hard to realize that a war is going on until you look at the activity in our plant. Like you, we are working to help end it as quickly as possible. And then we will both be able to sit down and do something really constructive.

Yours until Victory,

*M. L. Seekius*

M. L. SEEKIUS  
Factory Manager



## The art of PUTTING IT ON!

Remember Marcelene? If you were ever a youngster, you can't forget him—Greatest circus performer of all time . . . and tops in the art of facial make-up. His features, as he remade them, were his fortune.

Die faces, too, have fortune-making potentials. All they require is a skillfully applied skin of hard chrome plating. The right deposit in the right

places assures a long run of perfect performances.

Whenever it comes to a competition between an Industrial hard chrome plated die and a large quantity press order . . . the order gives out first!

Because of our highly developed techniques in applying chrome plate, we invite the opportunity to discuss complete details with you.

**INDUSTRIAL** *HARD CHROMIUM* **Co.**  
 "Armorplate for Industry"

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## *Can Our Skill Help You?*

The Chicago Screw Company's skill in producing Brass Screw Machine Products may be of invaluable help to you. While we handle all types of jobs from the simplest to the most complicated, it is on the really *tough* jobs that we can demonstrate the full value of our experience, engineering ability and modern production facilities...If your problem involves plastics, brass or steel screw machine products involving secondary operations — remember "Chicago Screw" the outfit with the "Know How."

**THE CHICAGO SCREW CO.**  
1026 So. Homan Avenue • Chicago 24, Ill.





Two P-K Type "Z" Self-tapping Screws with Phillips Recessed Heads are used to attach a plastic lamp bracket to the Skullgard. Two Type "U" Drive Screws are used to fasten a metal lamp holder,  $\frac{3}{4}$ " thick, to molded lamp bracket. The Skullgard is made of laminated plastic .060" thick.

**MINER'S "TOP HAT"**  
**Assembled Twice as fast**



**The P-K Self-tapping Screw method eliminates tapping time and expense ... provides stronger fastenings**

Because a fastening can be made with a P-K Self-tapping Screw in one simple operation — driving the screw in a plain untapped hole — the makers of Skullgards estimate they save 40% to 50% in time over assembly with machine screws.

Other advantages also prompted the choice of P-K Screws. The Type "Z" Screw used forms a close-fitting thread as it is driven, makes a stronger fastening, and stays tight in spite of the rough handling these helmets must withstand. In addition, this screw can be easily removed and replaced.

**Question every fastening** — on the drafting board, and in production! Ask for a P-K Assembly Engineer to help you find all the metal and plastic assemblies in which Self-tapping Screws will end trouble, speed work, save money. Or, mail assembly details for recommendations. Parker-Kalon Corp., 208 Varick St., New York 14, N. Y.

**PARKER-KALON**  
*Quality-Controlled*  
**SELF-TAPPING SCREWS**

**SKULLGARDS** made by Mine Safety Appliances Co., Pittsburgh, are the standard head protection for miners and construction workers. They have saved many thousands of war-important man-hours that would otherwise have been lost through injuries.

### THREE OF THE P-K SCREWS USED FOR PLASTIC ASSEMBLIES



**Type "Z" Thread-Forming Screws** — All purpose, form their own threads in the material. For fastening to cellulose acetate and nitrate compounds, methyl methacrylate resins, polystyrenes, laminated phenolics, and metal.



**Type "F" Thread Cutting Screws** — Expressly developed for use in crumbly and friable materials, such as phenolic and urea base compounds, cold mold compositions, and hard rubber. Also for metals. Cuts a thread like a tap.



**Type "U" — For Permanent Fastenings** — For use in all kinds of plastics and metals. Hammered or otherwise forced into the material, it forms its own thread. Cannot be removed.

SELF TAPPING SCREWS FOR EVERY METAL AND PLASTIC ASSEMBLY



**BETTER GROMMETS  
POINTED THE WAY TO THIS**

# *Better Nipple*

**T**HE rubber shortage forced Auto-Lite's Bay Manufacturing Division into the manufacture of grommets from a synthetic compound. But it wasn't long before these plastic products demonstrated marked advantages. They resisted oil damage. Cracks didn't develop as readily to form paths for treacherous electrical shorts.

So it was natural for engineers and designers to turn to Auto-Lite when a problem developed in supplying nipples for high tension circuit connections on coils and distributor caps. And again performance reports give evidence of a better product.

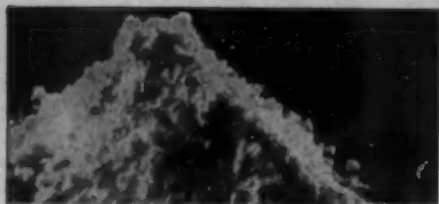
Already other developments are crowding for consideration, products calling for bigger areas, more difficult shapes. Auto-Lite engineers are bending every effort to show what can be achieved with injection and compression molding of plastics and meeting with remarkable success. Should you have a plastic problem which needs solving their experience in this field may prove helpful to you.

**THE ELECTRIC AUTO-LITE COMPANY**  
BAY CITY Bay Manufacturing Division MICHIGAN



*Specify*  
**AUTO-LITE  
PLASTICS**

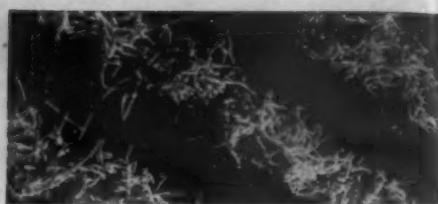
FOR THE DURATION... AND AFTER



**FILFLOC** Pure cotton flock of surpassing cleanliness and uniformity.



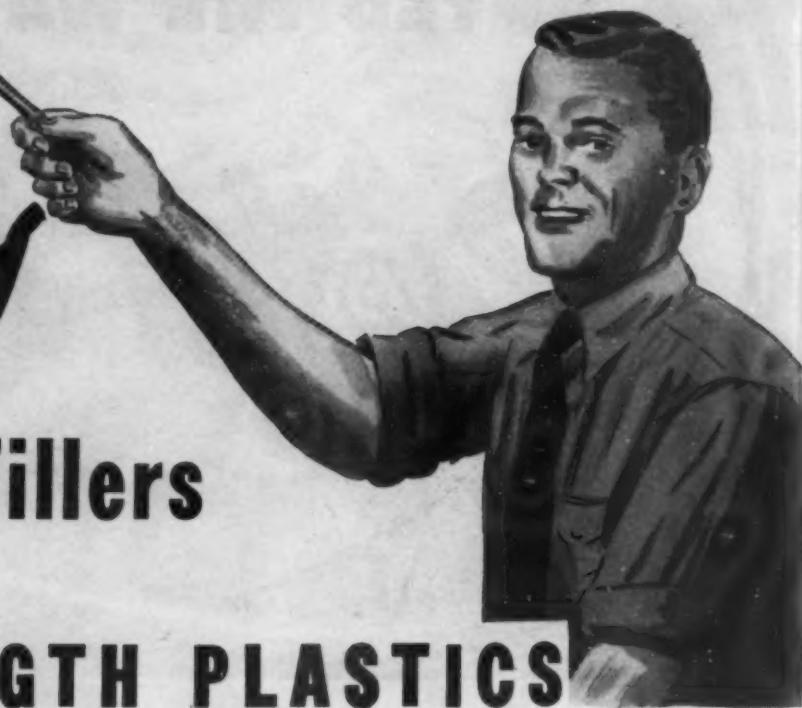
**FABRIFIL** Macerated cotton fabric for extra strength



**CORDFIL** Evenly cut lengths of tire cord for plastics of utmost strength.

# 3 types of "RAYCO" Fillers for

## EXTRA-STRENGTH PLASTICS



In our specialized field of Fillers, we have endeavored to match in care and thoroughness the research efforts of plastics technicians. As a result, you receive from Rayco not merely general types of fillers, but also a wide variety of different cuts in each type.

Your compound manufacturer gets prompt and intelligent cooperation from us in determining just the right filler for your purpose.

And once the specifications are deter-

mined, he knows he can depend on Rayco for strict adherence to them, assuring the dependable results that come from good, solid standards of uniformity and quality control.

For "know-how" on Fillers, consult Rayco.

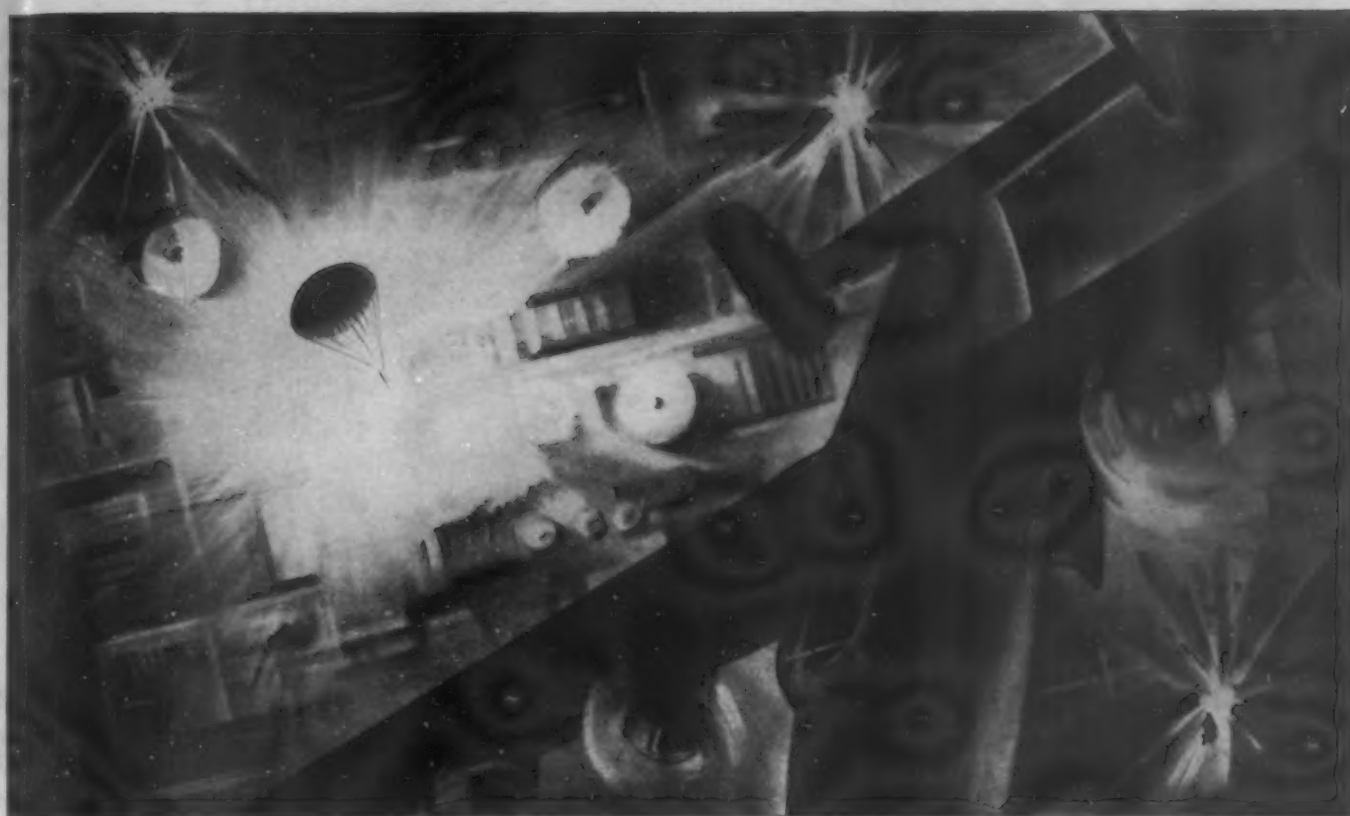
Occasionally we are asked to render cutting service on products outside our line. We are glad to consider such requests.

**RAYON PROCESSING CO.** of R.I. INC.

60 TREMONT ST., CENTRAL FALLS, RHODE ISLAND

*Developers and Producers of  
Cotton Fillers for Plastics*

**OBTAIN COMPOUNDS CONTAINING RAYCO FILLERS—FOR GOOD FLOW AND EXTRA STRENGTH**



## Planting A Victory Garden . . . *by Candle=Light*

A STRANGE and fearful candle-light brightens the streets of this Axis town tonight. A moment ago, it lay safely hidden under cover of a moonless blackout.

But, it was on tonight's schedule of time-table bombing and as "Libs" and "Forts" come in for the "kill", this night-time enemy target is brought into sharp relief by the brilliance of McAleer military pyrotechnics.

In that revealing glare the refinery's oil tanks stand out like giant mushrooms in a meadow—but not for long. Caught in the cross-hairs of a bombsight, they disappear in thick black smoke. A power station crumbles under a well planted "stick". Factories and warehouses belch

flame that reaches fiery fingers into the heavens.

It's Victory Garden planting of a different sort. Seeds of retribution from which will come fruits of Victory!

Making military pyrotechnics is but one of the important war production tasks assigned to McAleer. There are other For-Victory products extending into the fields of military aeronautics and hydraulics as well.

ON THE HOME FRONT we fight the war too . . . furnishing *quality-controlled* finishing materials and methods which contribute more to the war effort. If increased finishing efficiency on metal, plastic or wood can help YOUR war effort . . . our advisory facilities are at your service.

**McAleer**  
MANUFACTURING CO.



Manufacturers of Quality  
Controlled Finishing Materials

ROCHESTER, MICHIGAN

**RADIAL  
LOAD  
ONLY**

**Compound Loads Can't "Pile-Up"  
Beyond Rated Load Limits . . .**



You never have to worry about combined radial and thrust loads piling up on a single bearing when installing Rollway Roller Bearings. Because with Rollway's right-angle loading, there just isn't any such thing—a radial bearing carries the radial load, and a thrust bearing carries the thrust load. Or, if there's just one load—either radial or thrust—you use just one bearing. It's as simple as that.

Naturally, the magnitude of either the thrust or radial load component is smaller than the combined magnitudes of the two. Thus, you get a capacity margin you frequently can use either for a heavier load, a higher shaft speed, a longer life expectancy, or a proportionate combination of all three. Or you can cut down on the size of the housing and use a smaller size bearing. Whichever you choose to do, you'll find that Rollway gives you a better run for your money . . . that it simplifies and standardizes your bearing problems.

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**1** Now, wait a minute, professor . . . why all the hubbub? That's no different than a pre-war cow! After this war is won, many an item will look exactly the same as it did before. So let's not get excited about "Post-War Cows".



**3** Let's do get excited about the Precisionometer handle. Part of a precise inspection instrument . . . lighter, stronger, more durable even than required. No "Post-War Cow", this handle will continue to be manufactured of plastics, during peace-time, also.

**2** Let's get excited about the job plastics can do after this war is won. Creating new products of plastics . . . creating better products with plastics . . . that's what we like to do at Precision Plastics Company. If your product is a "Post-War Cow", we urge you to return to the proper material. However, if it lends itself to plastics, write us today. Let our engineering department work with you. We can help you plan for your post-war world!



**PRECISION  
PLASTICS COMPANY**

1724 W. INDIANA AVE., PHILADELPHIA 32, PA.

\* We know that despite war-time shortages many items are being made of their original materials. These items are not adaptable to plastics. We also know of many cases where plastics are being used simply as substitute material. When we return to normalcy these items will again be manufactured of their pre-war material. Two good examples of what we mean by "Post-War Cow"!

# PICTURE OF A MAN QUOTING FROM HIS OWN WORKS



"The appearance of any piece depends greatly on the type of material used and the work applied in the finishing operation.

• • • • •

"Every time the flash is filed off, a raw edge will appear.

• • • • •

"Fabric filled material will have fabric itself in the flash. The removal of that fabric is well nigh impossible without leaving shreds of fabric behind.

• • • • •

"Unfortunately, you can't lather and shave that edge, so you must accept a certain roughness where such flash is removed.

• • • • •

"The best test of an inspection is to test it against the difficulties of molding {the material called for} and be tolerant."

... excerpts from pp. 50-51 of "A Ready Reference for Plastics," published by the Boonton Molding Company. A note on your letterhead will bring you a copy without charge, providing you are a businessman or a Government employee.



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Franklin was the first injection plastic molder to receive the Army-Navy "E" award for "high achievement in the production of war material". This award was later supplemented with an award of a star to indicate continuing production accomplishment.

Franklin has learned the lesson of operating at high speed with precision and efficiency.

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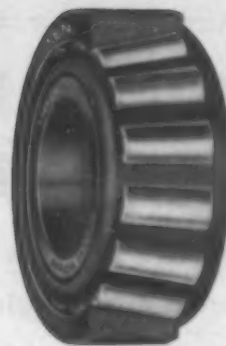
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Most of the standard equipment that has been adapted to plastics production — particularly machine tools — was equipped with Timken Tapered Roller Bearings long before the manufacture of plastics materials and products attained industry proportions. Such equipment as lathes, grinders, drilling machines, boring machines, milling machines, mechanical presses, planers, etc.

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Make sure you have Timken Bearing benefits in your plastics machinery — whether you are an equipment manufacturer or user; it will pay you many times over. The Timken Roller Bearing Company, Canton 6, Ohio.

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in  
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and  
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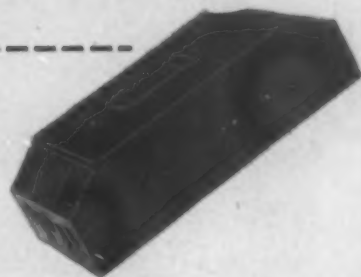
The tenth in Alco's series of plastics applications.

## The BIG "case" that was solved by plastics

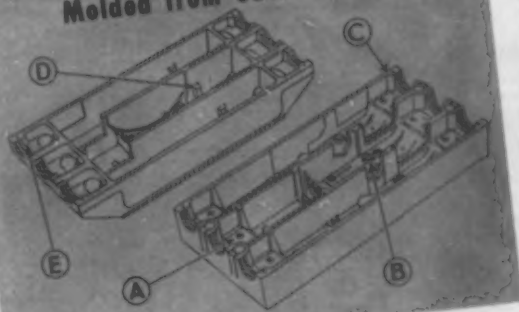
ONE of plastics' big jobs . . . in both dimensions and design . . . is this I-T-E Circuit Braker case, molded by Aico.

Base and cover each measure  $19\frac{1}{2}'' \times 9'' \times 3''$ . Strength and safety features are molded-in . . . in a single operation.

Aico engineers found use for their 28 years of experience in solving this circuit breaker case in plastics. The finished product combines strength and clean appearance, affords maximum protection to operator and mechanism and is designed for simple installation.



### I-T-E CIRCUIT BREAKER CASE Molded from 3510 Bakelite



**MOLDING MATERIAL**  
3510 Bakelite has the necessary properties for housing thermostat-operated apparatus. This material has high resistance to mechanical shocks, excellent insulating qualities and a low coefficient of expansion. Moldings can be held to close dimensions—necessary in a part of this type to allow accurate location of internal mechanism.

**DESIGN**  
Intricate design of both base and cover called for Aico's high-precision mold-making skills. Each part weighs over  $6\frac{1}{4}$  lbs. and is molded in a one-cavity mold. Design includes 6 large metal inserts (A) and 8 small threaded metal inserts (B). Heavy wall sections were provided at corners of cover and base for extra strength (C). Ribs (D) incorporated to strengthen wall sections and support interior mechanism. Fillets (E) at all corners prevent weakness and cracking at points of strain.

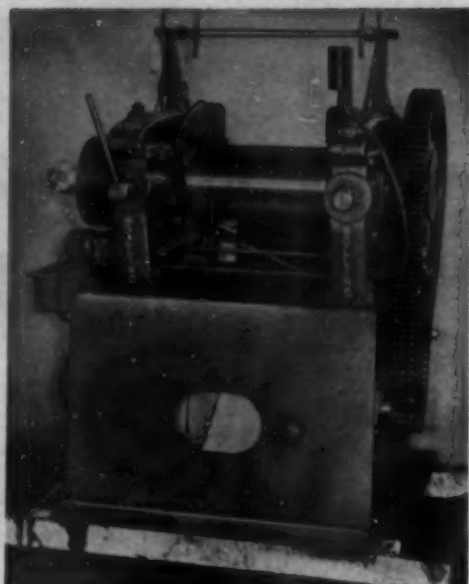
**MOLDING METHOD**  
Compression molding is the only practical method for a part of this size. Pieces are molded on a 1400-ton press, one of the largest in the industry. Two of each piece, or two complete units, are molded in one hour.

Keep an up-to-date file of Aico's series of plastics applications for reference. Write us for additional copies of cards 1 to 10.

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29th Year

AMERICAN INSULATOR CORPORATION, New Freedom, Pa.

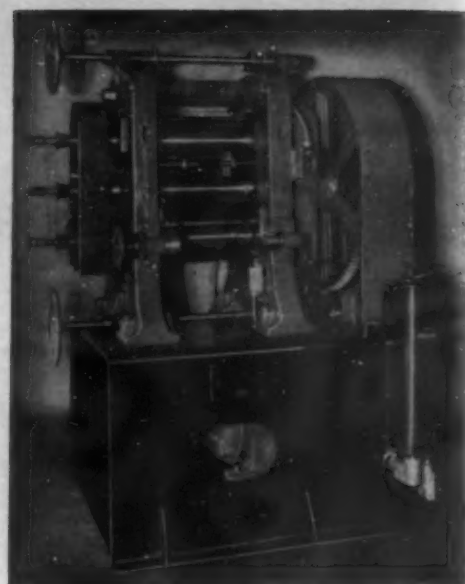
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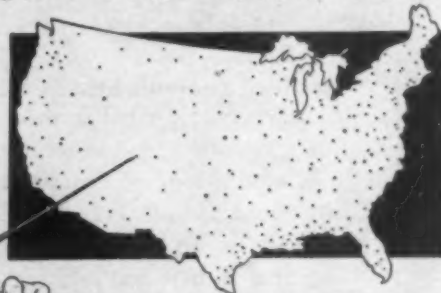
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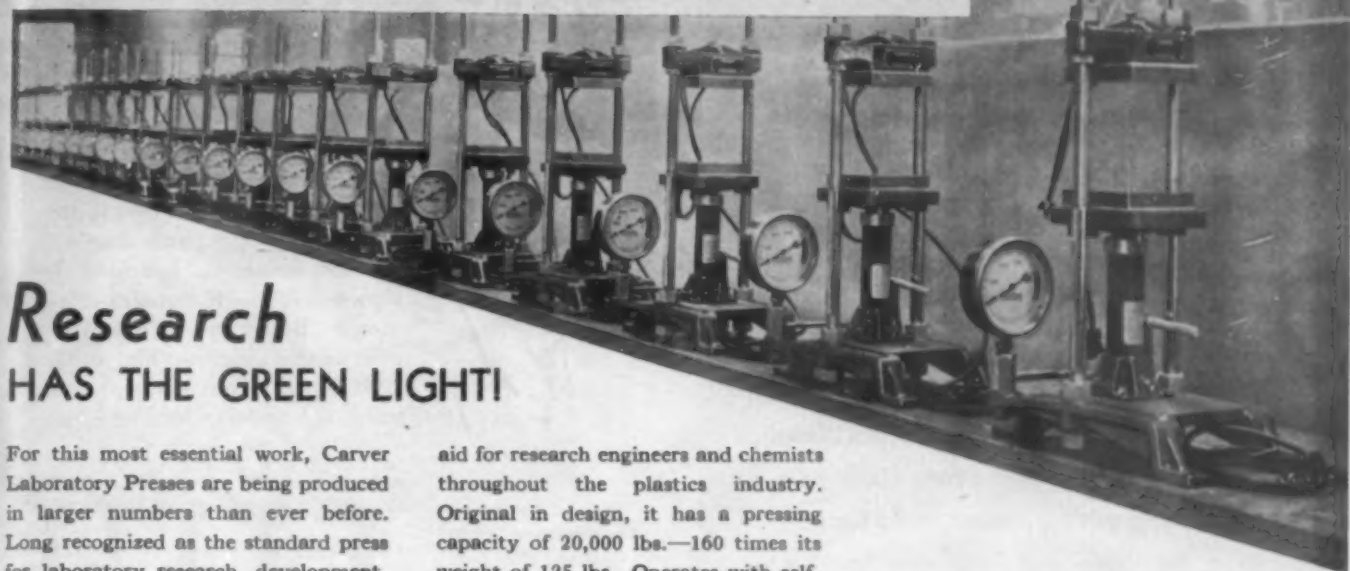
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Exterior of Infra-Red Conveyor Belt Tunnel for removing moisture from plastic material prior to molding.



Sides dropped to show arrangement of Infra-Red light bank and materials passing under light conveyor belt.

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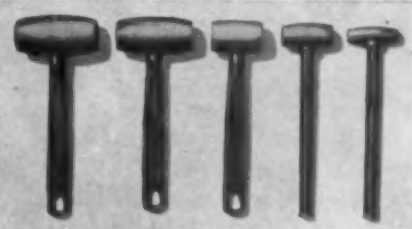
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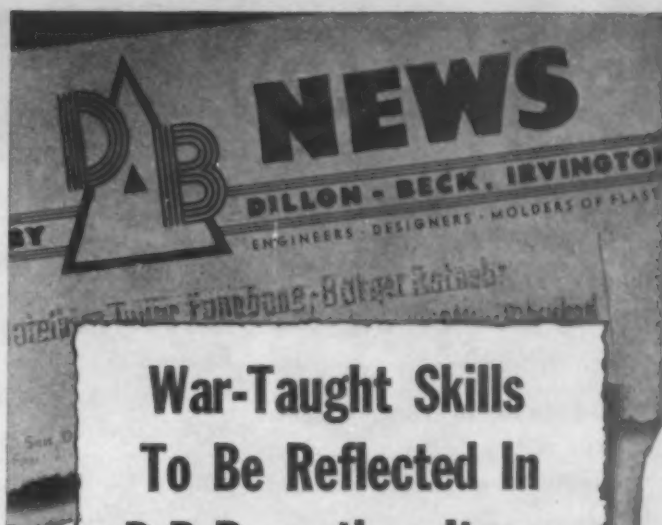


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"In addition, a gradual expansion of facilities enables us to supply the complete and comprehensive type of service that carries through from original plan to finished product."

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for Permanence...

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Designed and produced by one of the nations leading molders, Dillon-Beck Mfg. Co., Irvington, N. J., in collaboration with the U. S. Signal Corps, the Rain Gage is now being widely used by the armed forces to measure rainfall, so essential to the successful planning and waging of war.

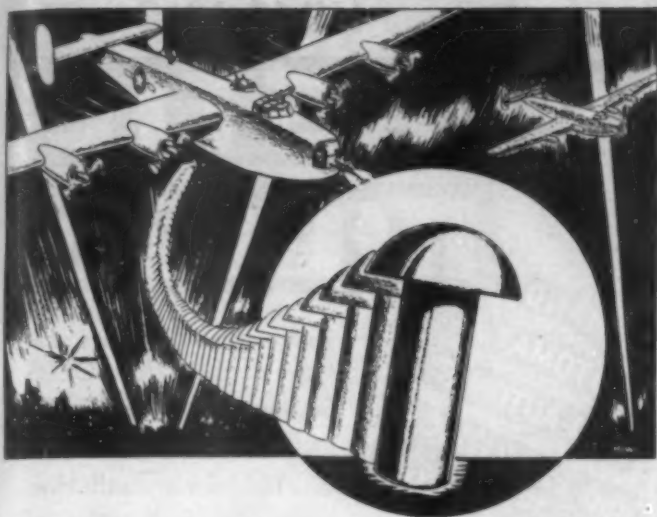
Calibrating the Rain Gage to such close tolerances offers convincing proof that Rogan can do your branding on plastics, no matter how exacting your requirements may be.

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Soon now this interlude we call "war" will end and the current of life will return to normal channels—which, in industry, means supplying people's peace needs. How these markets will affect your particular company you are in best position to judge, but how tubular rivets can best fit into your product can most satisfactorily be determined by a joint meeting of your design engineers and our rivet experts.

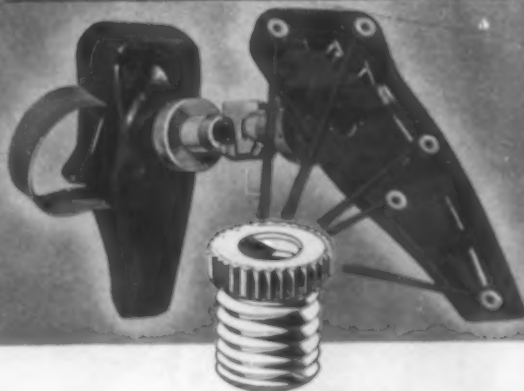


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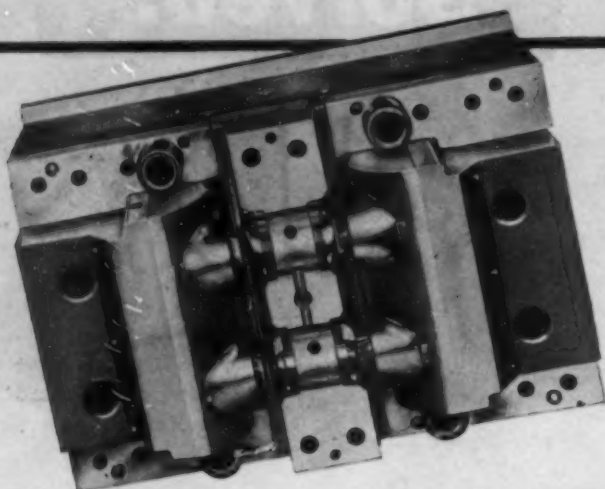
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*...without frequent redressing*



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The very nature of this molded product made a smooth lustrous finish a necessity.

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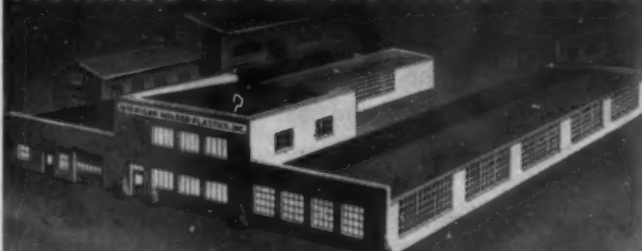
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After this has been accomplished and once again we can turn all our efforts to a post-war era, we want to demonstrate our ability to fashion the better things to come in molded plastics.

Fundamental knowledge, advanced thinking and new techniques combined with experience and the ability to produce will again attract users to our plant — one of the \*time-proven plants in the plastic industry.

\* Average employee over 20 years plastic experience.

**MICHIGAN MOLDED PLASTICS, Inc.**

Dexter

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CUSTOM MOLDING  
COMPRESSION • INJECTION • EXTRUSION

*We're Molding  
a Brilliant Future--*

*— because we're entrusted  
today with the molding of vital  
plastic parts for almost every  
branch of the armed services.*

Ideal Plastics Corporation is a complete organization dedicated to the ultimate in Plastic Molding— injection and extrusion. At Ideal you can count on top flight engineering and production by one of the foremost groups of trained specialists in the field of plastics. This skilled organization is offered to you today—to discuss your post-war plastic plans—so that we may serve you better "tomorrow" when we are again in civilian production.



A SYMBOL  
OF FINEST  
CRAFTSMANSHIP  
IN PLASTICS

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A DIVISION OF IDEAL NOVELTY & TOY CO., INC.  
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## POST WAR PLASTIC SALES

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BOOKLET ON REQUEST

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Whatever the fluid used in your plant—air, water, or oil—and whatever the pressure, up to and including 6,000 lb. per sq. in.—it can be handled without shock by this

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Numerous plastics plants are now using this extraordinary valve and are well pleased with it. Repeat orders are received by us nearly every day.

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There is nothing secret about it. Built by a concern that specializes in regulating valves it is based on the latest and best principles. Every part is up-to-date in every respect. Forged Steel Body. Internal metal parts entirely of stainless steel.

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REGULATING VALVES FOR EVERY SERVICE

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Representatives in principal Cities



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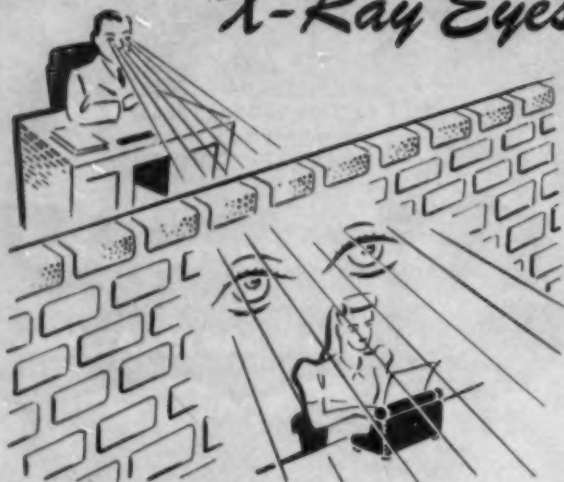
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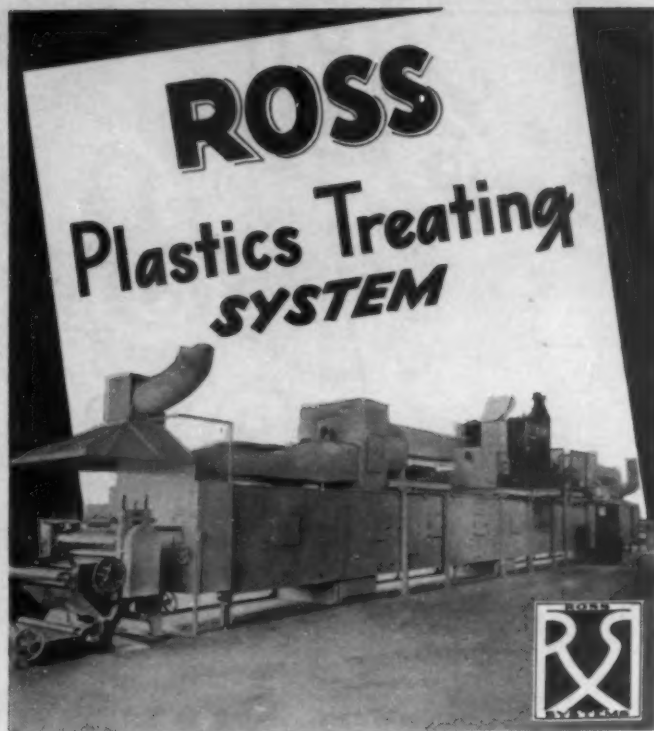
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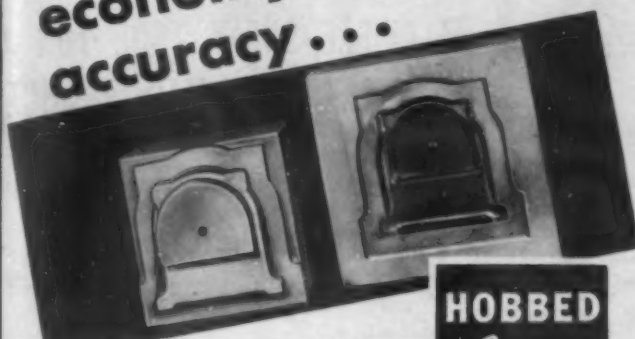
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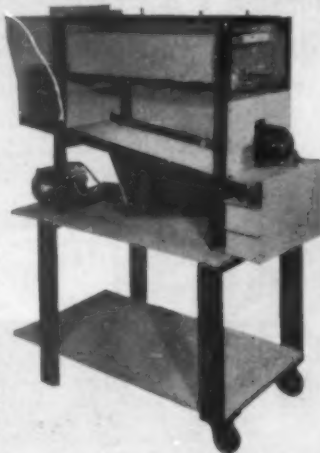
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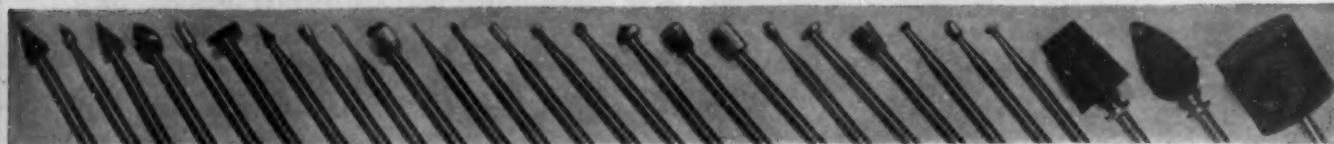
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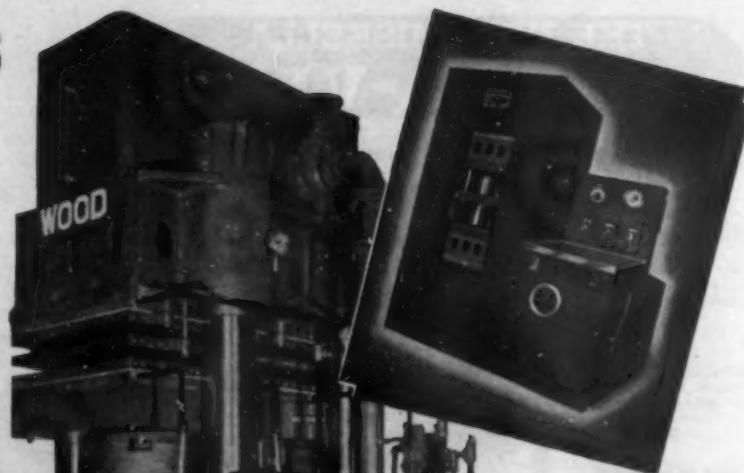
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A complete line to meet the requirements of all types of plastics compounding. We will gladly provide laboratory assistance in helping determine plasticizers best suited to your specific problems.

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Pre-test your idea, demonstrate your new product to prospects and get orders in advance of production with plastic models.

Precisely built in all plastics particularly in transparent materials which show the inside workings of your product.

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This applies, of course, only to war orders and uses approved by WPB.

Let us discuss your extrusion problems with you.

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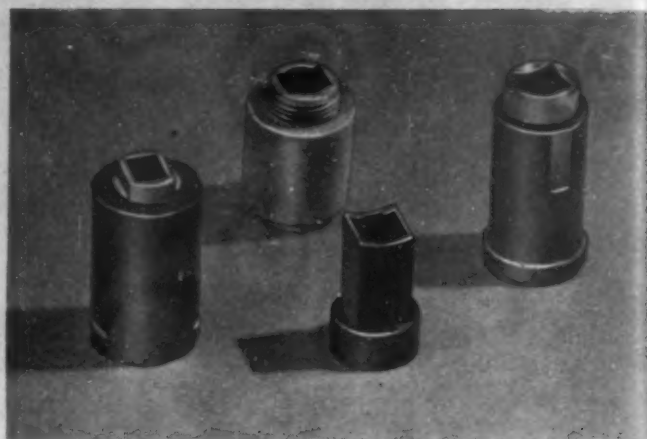
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**Custom Molded Plastics** engineered by Midwest, consistently measure up to exacting specifications and requirements. Address your inquiries to MMM, confident that you are consulting an organization skilled and experienced in precision techniques for the production of plastics.

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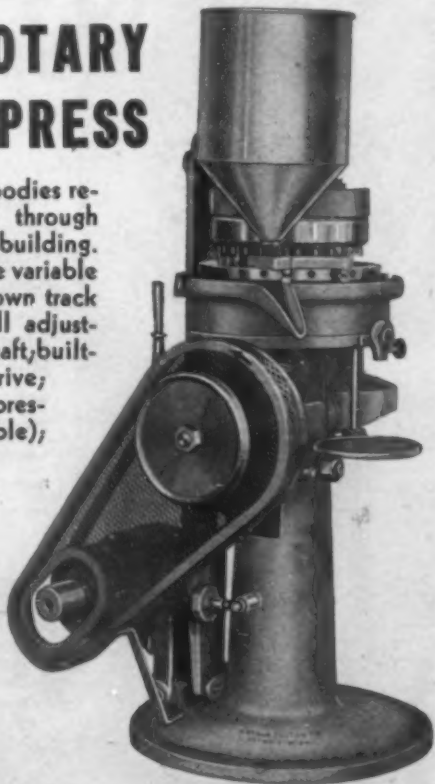
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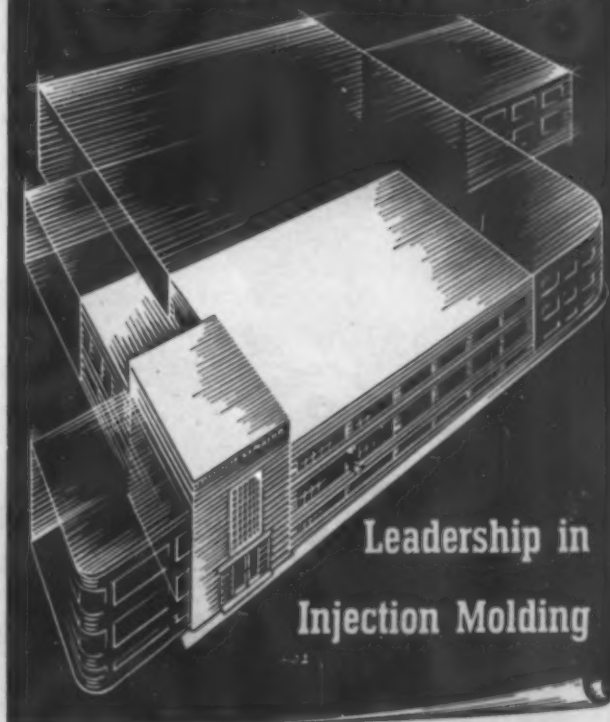
Other facts: capacity: 300-800 tablets p.m.; tablet diam.:  $\frac{3}{16}$ "— $\frac{5}{8}$ ", max. cell depth:  $\frac{11}{16}$ "; floor space: 30" x 36", height: 60", net weight: 1025 lbs.



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Leadership in  
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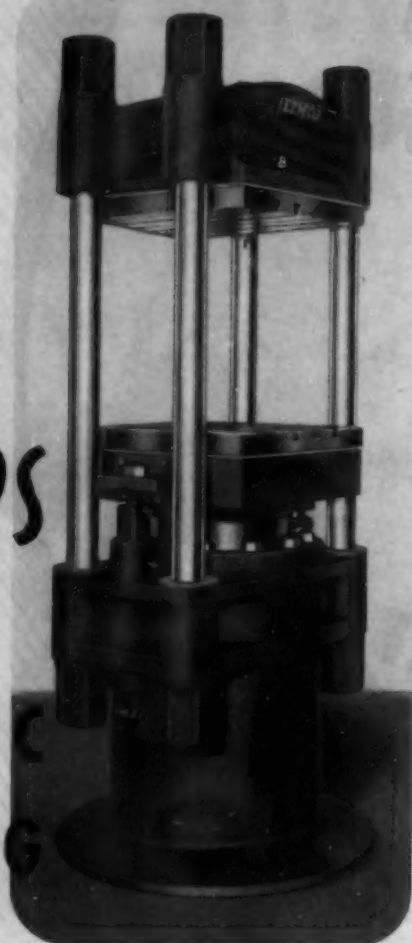
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# MODERN PLASTICS

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